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The U.S. Air Force Medical Service presented the fifth annual Air Force Medical Research Symposium coordinated by the Air Force Medical Support Agency's Research and Development Division (AFMSA/SGRS). The symposium was held 24-26 August 2010 at the Doubletree Hotel Washington DC – Crystal City, Arlington, VA. The symposium featured two half-days of plenary sessions, one and a half days of scientific presentations, and a poster session. It was organized into four tracks to include: Operational & Medical, Enroute Care, Force Health Protection, and Nursing. These proceedings are organized into five volumes to include one that provides a general overview and all presentation and poster abstracts; the other four each address a specific track. Volume 1contains a general overview of the entire 2010 Air Force Medical Research Symposium and includes abstracts of all the oral presentations and posters, information and presentations from the opening and closing plenary sessions, symposium agenda, and attendee list.

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Proceedings of the 2010 AFMS Medical Research Symposium

Volume 1. Plenary Sessions, Presentation & Poster Abstracts

Volume 1 of 5

Proceedings of the 2010 AFMS Medical Research Symposium

Symposium Planners

FROM:

Office of the Air Force Surgeon General

Directorate for Modernization

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Proceedings of the 2010 AFMS Medical Research Symposium Volume 1. Plenary Sessions, Presentation & Poster Abstracts

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Held
24-26 August 2010
at the

Double Tree Hotel Washington DC – Crystal City
300 Army Navy Drive
Arlington, VA 22202

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Proceedings of the 2010 AFMS Medical Research Symposium

Introduction

The U.S. Air Force Medical Service presented the fifth annual Air Force Medical Research Symposium coordinated by the Air Force Medical Support Agency's Research and Development Division (AFMSA/SGRS). The symposium was held on 24-26 August 2010 in the Washington D.C. area at the Doubletree Hotel Washington DC – Crystal City in Arlington, VA. The symposium featured two half-days of plenary sessions, one and a half days of scientific presentations, and a poster session.

The symposium was organized into several tracks to include Operational & Medical, En-route Care, Force Health Protection, and Nursing, as follows:

- The Operational & Medical Track focused on patient care and treatment in garrison, expeditionary care during contingency operations, and enhancing performance of airman in challenging environments.
- The Enroute Care Track addressed science and technology targeted at the continuum of care during transport from point of injury to definitive care to include medivac, aeromedical evacuation, critical care air transport, patient staging, and patient safety.
- The Force Health Protection Track focused on prevention of injury and illness and the early recognition or detection of emerging threats for in-garrison or deployed operations. Topics of interest include research in bio-surveillance, infectious disease, emerging threats (pandemic response), protective countermeasures, disaster response/consequence management, toxicology/health risks (e.g., particulates nanomaterials, radiation, etc.), monitoring disease trends, other areas of preventive medicine, public and environmental health relevant to the military workforce.
- The Nursing Track focused specifically on evidence based practice.

These proceedings are organized into five volumes, as follows:

- Volume 1. This volume is a general overview of the entire 2010 Air Force Medical Research Symposium and includes abstracts of all the oral presentations and posters. First presented is the symposium's opening plenary session, followed by the abstracts from the four technical tracks, and then the closing plenary session. The abstracts associated with the poster session are in the last section of these proceedings. The agenda for the overall symposium is in Appendix A, attendees are listed in Appendix B, and continuing education information is in Appendix C of this volume. Appendices D-L are copies of presentation slides from the plenary sessions.
- Volume 2. This volume contains abstracts and presentation slides for the Operational & Medical Track.
- Volume 3. This volume contains abstracts and presentation slides for the Enroute Care Track.
- Volume 4. This volume contains abstracts and presentation slides for the Force Health Protection Track.
- Volume 5. This volume contains abstracts and presentation slides for the Nursing Track.

Welcome & Overview

Overview and Opening Remarks	**Nereyda Sevilla** **SGRS**
SGRS Welcome	**Col Don White** **Director, Research and Development**
SGR Welcome	**Brig Gen James Carroll** **Commander, Air Force Medical Support Agency**

Opening Plenary Session

Presentation slides are in appendices as noted.

Keeping Our Promise Through Medical Research and Development (See Appendix D)	**Dr. Peach Taylor** **Deputy Assistant Secretary of Defense for Force Health Protection & Readiness**
Defense Medical Research and Development Program (DMRDP)	**COL Dallas Hack** **Director, US Army Combat Casualty Care Research Program**
Armed Forces Institute of Regenerative Medicine (AFIRM) (See Appendix E)	**LTC Brian Moore** **Program Manager**
Defense Technical Information Center (DTIC) (See Appendix F)	**Ms. Shari Pitts** **DTIC** **Information Collection Division**

Presentation Abstracts

Operational and Medical Track

ABSTRACTS

Tuesday, 24 August 2010

1300 Attenuation of Altitude De-acclimatization/Neocytolysis with Exercise Intervention

Human Performance Laboratory- United States Air Force Academy

Michael D. Brothers, Jeffery L. Nelson, James A. LaChapelle, Bryan S. Wynkoop, Cole R. Schindler, Elizabeth C. Grossmann, Tyner M. Apt, Erlyn R. Rudico, Laura Nelson, and Michael F. Zupan

INTRODUCTION: Astronauts and high-altitude (>4000m) residents experience neocytolysis—a rapid reduction in total hemoglobin mass (THM)—upon return to sea level (SL; <300m). Whether exercise intervention can mitigate this loss is unknown. PURPOSE: This study examined changes in THM among moderate altitude (MA; ~2210m) residents who completed various 'exercise prescriptions' during a three-week winter break spent at SL. Based on previous studies, we expected all subject's THM to decrease significantly; however, we hypothesized cadets performing high-intensity exercise would minimize THM loss. METHODS: Fifty three cadet subjects (39 male, 14 female) age 20.5 $\pm$ 1.5 years participated in the study. Each subject was scheduled for THM assessment using the optimized CO re-breathing protocol twice the month prior to departing for SL, and twice upon their first week returning to MA. Subjects were classified into one of three groups: 'control' (moderate exercise), 'interval' (high intensity), or 'endurance' (high volume). Statistical analysis consisted of 1-tailed independent sample and paired T-tests with $p \leq 0.05$. RESULTS: All subjects had a significant ($p < 0.001$) loss in THM over winter break, losing 3.7% (-28.3 $\pm$ 29.3g) on average. The 'interval' group lost only 2.9% (-23.0 $\pm$ 33.2g), while the 'control' group lost 4.9% (-37.3 $\pm$ 27.0g), which neared statistical significance ($p = 0.061$). The 'endurance' group lost 3.3% (-25.1 $\pm$ 26.7g; $p < 0.1$, compared to the 'control' group). CONCLUSIONS: All subjects' THM significantly decreased despite exercise intervention while at SL. However, exercise intervention attenuated THM loss, and the interval group's decrease neared statistical significance.

1330 Impact of Alternating Days of Intermittent Hypoxic Exposure (IHE) on Physical and Cognitive Performance

United States Air Force Academy- Alabama Department of Public Health (ADPH)

Michael F. Zupan, Monica S. Herrera, Lynette M. Lennemann, Julia N. McGregor and Thomas B. Walker

BACKGROUND: Unacclimatized military personnel rapidly deployed to moderate altitude (MA) (2750-3660m) environments are subject to physical and cognitive performance impairments. PURPOSE: The primary purpose of this study was to determine if alternating days of intermittent normobaric hypoxic exposures (IHE) for unacclimatized, sea-level residents works as a training strategy to minimize physical and cognitive impairments in battlefield airmen during MA deployments.

METHODS: We conducted a crossover style, randomized study to assess the efficacy of IHE on performance decrements. Baseline physical and cognitive tests were conducted at sea level (SL), normobaric hypoxic (NH), and hypobaric hypoxic (HH) environments. Subjects were randomly assigned to either five consecutive (C-IHE) or five alternating (A-IHE) days of IHE. All tests were repeated post-IHE exposure. Following a four-week washout interval, all subjects repeated the process again under the opposite IHE exposure schedule. Intra-subject differences between training regimens (C-IHE vs. A-IHE) and the three environments (SL vs. NH vs. HH) were analyzed. RESULTS: Seven well-conditioned (VO2 max = 57 mL-1.Kg-1.min) male subjects (30.4 + 8.7 yrs) completed the study. Significant physiological differences ($p<0.05$) between SL and NH or HH were observed. There were significant differences at HH environment for anaerobic endurance distance ($p=.01$), but not VO2 max ($p=.27$), max HR ($p=.21$) between C-IHE and A-IHE training regimens. Analysis of cognitive and acute mountain sickness data is ongoing and will be reported at the Symposium. **CONCLUSIONS:** C-IHE may result in greater altitude adaptations than A-IHE allowing battlefield airmen to better prepare themselves for MA deployments.

This study was funded with a research grant provided by the Air Force Surgeon General Office and the Air Force Research Laboratory.

1400 Altitude-related Differences in Running Economy among Sea Level Residents during 46 Weeks at Moderate Altitude

United States Air Force Academy- Alabama Department of Public Health (ADPH) Human Performance Laboratory, United States Air Force Academy, 2169 Field House Drive/Ste. 111, USAF Academy, CO 80840

Jeffrey L. Nelson, James A. LaChapelle, Elizabeth C. Grossmann, Michael F. Zupan, Brandon K. Doan, Michael D. Brothers

INTRODUCTION: Although improvement in sea level (SL) running economy (RE) following short-term altitude exposure has been demonstrated, changes in RE among SL residents following chronic moderate altitude (MA; 2210m) residence have not been examined. PURPOSE: To assess differences in RE between SL and MA subjects during 46 wks of chronic residence at the U.S. Air Force Academy. It was hypothesized that SL subjects would have significantly worse RE initially, but RE would improve following MA acclimatization.

METHODS: 55 male subjects (18.7 +/- 0.7 yrs) from SL (n = 44) and MA (n = 11) had their RE assessed (6-9 mph) on 5 separate occasions over 46 wks. Correlations between total hemoglobin mass (THM) and RE data were assessed. Subjects were supplemented with either iron or placebo.

RESULTS: SL subjects had significantly ($p < 0.05$) worse RE compared to their MA peers after 8-10 wks at MA at all velocities examined (46.0 +/- 4.3 vs. 42.7 +/- 3.4 ml/kg/min; SL vs. MA, respectively). All subjects' RE changed significantly ($p < 0.05$) over time. The altitude-related difference became non-significant after +16-18 wks. There was no difference in RE due to iron supplementation. Despite changes in RE and THM among SL subjects residing at MA, there were no significant correlations between THM and RE. CONCLUSIONS: Significant altitude-related differences existed in RE and THM for 15+ wks at USAFA, but did not correlate significantly. These data suggest chronic MA acclimatization results in changes to both RE and THM, but unique adaptations may underlie each.

This research funded by a HQ AF/SGRS grant.

1445 AFRRI's history, mission, and current research and education programs

Armed Forces Radiobiology Research Institute (AFRRI), Bethesda, MD

Maj Michael Dempsey

The concern of a major radiological or nuclear attack has been reduced since the end of cold war. However, the threat of nuclear or radiological terrorism has become a subject of increased interest, especially after the events of September 11, 2001. The Armed Forces Radiobiology Research Institute (AFRRI) is the only DoD facility dedicated to research on the assessment and treatment of radiation injuries. The research focus areas include biodosimetry; countermeasure development; elucidation of molecular basis of radiation injury, alone or with wound, burn, and/or infection polytraumas, as well as effective treatments; potential uses of radiation to defeat biowarfare and bioterrorism agents; and methods for treatment of internal contamination of military-relevant heavy metals. This presentation will provide an overview of AFRRI's history, mission, and current research and education programs.

1515 A Model Graduate Medical Education Military Unique Training Program

59th Medical Wing (MDW)/59 MCCS, Lackland AFB, TX

LtCol Vinod Gidvani-Diaz

The San Antonio Uniformed Services Health Education Consortium Pediatric Residency ongoing program in Honduras is designed to give military pediatric residents a unique experience in International Health and Stability Operations. The training, which combines didactic learning stateside with hands on experience in Honduras, focuses on health conditions that cause morbidity in post-war/disaster scenarios.

During the two week preparatory phase, residents are exposed to a curriculum that is geared toward understanding goals of Stability Security Transition and Reconstruction Operations (SSTRO), command structure used the military in joint operations, and planning and executing a Humanitarian Civic Assistance mission. Trainees also complete the Military Medical Humanitarian Assistance Course, a 2-day program designed to teach providers from varying backgrounds the unique and practical aspects of pediatric medicine in austere, resource-limited environments.

In the in-country phase of the program, participants conduct a two-week Medical Readiness Training Exercise in rural Honduras. Residents plan all mission aspects including intelligence briefs, creating an operational plan and coordinating it with chief stakeholders, and preparing logistical support. During execution of the mission, trainees learn and demonstrate competence with practical military field skills, gain

understanding of health care systems and delivery of care in a developing country and practice empiricism-based medicine while being exposed to unique medical conditions not encountered in stateside training.

Post-residency surveys have shown that the skills learned during this GME training experience have been invaluable as most graduates have deployed to wartime and peacetime missions and encountered similar circumstances. This program serves as a model for in-residency military unique training.

1545 An Overview of Combat Wound Initiative Program and Biosurveillance Efforts at Armed Forces Institute of Pathology
Armed Forces Institute of Pathology

Mina Izadjoo, Ph.D., Mohammad Alavi, Ph.D., Maj Thomas Shaak, COL Peter Weina and COL Alexander Stojadinovic

Combat Wound Initiative Program (CWIP) is a collaborative, multi-disciplinary, inter-service Program providing state-of-the-art; complex wound care through targeted clinical and translational research incorporating advanced technology and treatment, tissue banking, and bioinformatics. This program provides a centralized leadership in establishing a strategic cooperation in studying wounds and candidate therapeutics. The goal is to deliver the highest quality advanced complex wound care to our wounded service members; to conduct first-rate integrated basic, clinical and translational research; and to advance personalized or individualized medicine.

A critical strategic partnership was recently established between the CWIP and the AFIP for the establishment and hosting of the CWIP Biospecimen Network program. This joint effort is aimed at wound bioburden analysis, molecular diagnostics and therapeutics using cutting edge instrumentation and techniques. In support of this effort, we have established a "Combat Wound Microbial Culture Collection" and "Antibiotic Resistance Plasmid Library". These collections will provide significant resource for DOD in conducting research in biosurveillance of combat related infections. This collaborative, multidisciplinary, inter-service program will clearly lead to the much needed improved treatment and fast recovery of our combat wounded soldiers. We will provide an overview of the ongoing efforts in support of an unprecedented initiative in biosurveillance of infectious agents using cutting edge instrumentation and bioinformatics. Our efforts may lead to developing much needed methodologies for differentiation between natural or intentional exposures to current and emerging infectious disease agents.

Wednesday, 25 August 2010

0800 Glucose Control in Critically Ill Adults at a Military Hospital
59th Medical Operations Squadron (MDOS)
Brian T. Allenbrand, MD, Lexa E. Rijos, MSN, RN, ACNP-BC, Stacey L. Ward, MSN,RN,CNS-BC,BC-ADM, Tricia L. Garcia, MPH, Joseph Pollard, MPH; Acknowledgments: Hsiang-Yu Chen*, MS, Donna L. Wolf*, PhD

Recent data in critically ill patients suggest aggressive management of hyperglycemia is not always associated with improved outcomes and may be associated with risks. Implementation of hospital-wide policies and standardized insulin protocols will assist providers in selecting the appropriate insulin regimen while avoiding adverse events. In January 2009, an intravenous insulin infusion protocol with new blood glucose (BG) targets of 100 to150 mg/dL was implemented in critical care units at Wilford Hall Medical Center. The insulin infusion is titrated according to protocol to obtain and maintain a goal value of 100-150 mg/dL. From January to May 2009 a total of 46 patients were placed on the protocol. Average age was 59 (58.8±17.5) and 58.7 % were male. Out of all three units 50% the patients had type 2 diabetes. Percentage of time patients were at target BG goal (100-150 mg/dL) was 52.3±21.1% (53.3±23.4% SICU 49.3±17.3% MICU, 69.6±29.7% CCU). The median duration to achieve goal was 5.7 hours (7.0, 5.4, 1.1, respectively). Hypoglycemia rates (< 60 mg/dL) averaged 0.8%, 1.0%, and 0.7% respectively. Length of stay (LOS) was stratified by vital status. Among survivors, the average LOS was five days with the longest LOS in the MICU (6 days) and shortest in the SICU and CCU (4 days). The largest difference according to vital status was observed in the SICU (3 days vs. 7 days). Although this is an initial evaluation of newly implemented target BG ranges, results shown are comparable to those demonstrated previously in the literature and this facility.

*affiliated with the University of Pittsburgh

0830 Management and Treatment of Pediatric Obesity in a Military Outpatient Setting
University of Pittsburgh Medical Center (UPMC)

Jodi Krall, PhD; Acknowledgements: Silva Arslanian*, MD, and Goutham Rao*, MD

The increasing prevalence of obesity in civilian and military dependent populations poses significant challenges in identifying future military recruits with appropriate physical qualifications. In addition, an increasing number of military dependents are diagnosed with risk factors for type II diabetes. The military will be affected by the tremendous humanistic and economic

burden unless prevention and treatment programs that include healthy lifestyle changes are implemented. For this reason, the University of Pittsburgh Medical Center partnered with the Air Force to develop an evidenced-based model for primary prevention of type II diabetes at Wilford Hall Medical Center at Lackland Air Force Base. The San Antonio Military Pediatric Center (SAMPC) Pediatric Wellness Center employs a multidisciplinary team approach to provide family-centered lifestyle intervention, counseling, and goal-setting strategies to implement therapeutic behavioral changes in overweight and obese high-risk children and adolescent patients and their families. The Center is also designed to serve as a hub-site for research studies supporting scientific advancement in the understanding of obesity, type II diabetes, and related conditions as well as for testing innovative treatment approaches. This presentation will be used to review the rationale for and design of the program; describe intervention techniques, which include standardized clinic-based lessons and Web-based interactive educational tools; present preliminary findings; and discuss of future directions.

*affiliated with Children's Hospital of Pittsburgh of UPMC and University of Pittsburgh

0900 Budget Impact Analysis of Bariatric Surgery for Morbid Obesity
University of Washington

Rafael Alfonso

Obesity is reported to increase mortality, morbidity, and costs. Bariatric surgery remains the most effective treatment for long-term weight loss. We developed a payer-based Budget Impact Model (BIM) to assess "Return On Investment (ROI)" for bariatric surgery in obesity compared to non-operative interventions.

The purpose of this BIM is to estimate the financial consequences of adoption of different types of Bariatric surgeries within a specific health care setting given inevitable resource constraints. The BIM can be customized based on the characteristics of the population of interest (i.e. number of lives covered, age, gender, and body mass index) and the alternatives of interventions presented (i.e. Different types of bariatric surgeries and/or different degrees of use of each procedure). Since each bariatric procedure has different costs, and may be associated with different levels of weight loss and complications; the inputs used for the costs, complications, and mortality rates, are derived from a Cost-Effectiveness Model from nationally representative databases and the best estimates from the published literature.

Average annual costs per patients for each procedure are multiplied by the number of eligible subjects receiving the specific procedure. These costs are accumulated over a 10-year period and compared to the cumulative costs of eligible subjects for bariatric surgery who did not receive the procedure. Results are expressed as the increment of total costs per member per year. By examining different scenarios, with different levels of eligibility and mix of surgical procedures, decision makers could estimate accurately the ROI associated with each alternative over time.

0945 Pilot Study of a Diabetes Prevention Program in a Military Community
USAF, Lackland AFB, TX

Lisa Strickland, MD, Joseph Pollard, MPH; Acknowledgements: Donna L. Wolf*, PhD, Hsiang-Yu Chen*, Ms, Linda Siminerio*, RN, PhD

INTRODUCTION: Approximately 57 million Americans ≥ 20 years have pre-diabetes, placing them at risk of developing diabetes (T2D) and cardiovascular disease (CVD). Despite having weight and fitness standards, incidence of T2D in military personnel is similar to the civilian population (1.9 vs. 1.6 cases per 1,000 persons per year). Progression to T2D among those with pre-diabetes is not inevitable. The Diabetes Prevention Program (DPP) demonstrated that a lifestyle intervention lowers the risk for developing T2D. PURPOSE: Our objective was to determine if a Group Lifestyle Balance (GLB) intervention (based on the DPP), for individuals with metabolic syndrome (MetS), is effective in decreasing risk for T2Dand CVD in a military community. Methods: This was a non-randomized pilot study. Participants from Wilford Hall Medical Center (WHMC) were screened for MetS (n = 58) and participated in a 12- week GLB (n=19) that focuses on safe weight loss and physical activity. RESULTS: Participants lost an average of 11.4 pounds over the 12 week period ($p < 0.001$). BMI decreased by 2 kg/m2 ($p=0.001$). Although not statistically significant, there was a clinically important decrease of 10mmHg in systolic blood pressure ($p = 0.07$). Glucose decreased by 3mg/dl, but was not statistically significant ($p = 0.06$). There was a significant decline in the number of MetS parameters from an average of three to two. Conclusion: Adults in a military community can decrease their BMI through participation in a GLB intervention. Effort to train military health professionals, e.g. nurses, dietitians, on the GLB is underway for program dissemination.

*affiliated with the University of Pittsburgh

1015 Decreased Blood Glucose Levels among Metformin Dependent Diabetics Undergoing Hyperbaric Oxygen Treatment
United States Air Force School of Aerospace Medicine (USAFSAM)/FEER, Brooks AFB, TX

Maj Todd Huhn

BACKGROUND: Previous studies have shown significant decreases in blood glucose levels of insulin-dependent diabetics undergoing hyperbaric oxygen treatment (HBO2). Under normobaric conditions, metformin is not generally associated with hypoglycemia, but there has been little done to look specifically at the effects of metformin on blood glucose levels in diabetics undergoing HBO2. METHODS: This case series study evaluated a cohort (n=16) of metformin dependent diabetic patients to determine whether metformin is associated with decreased blood glucose levels while undergoing HBOT. Data was obtained by chart review of patients from 2002-2009. Sixteen patients were identified who were solely dependent on metformin for glucose control. All patients received pre- and post-treatment blood glucose evaluations as well as clinical evaluations for signs and symptoms of hypoglycemia following HBO2. RESULTS: Pre-HBO2 glucose averaged 175 mg/dL (range 131-329) and post-HBO2 glucose levels averaged 144 mg/dL (range 63-337.5). Mean blood glucose levels demonstrated a statistically significant decrease of 33.1 mg/dL ($P<0.005$). None of the patients exhibited signs or symptoms of hypoglycemia. CONCLUSION: Statistically significant decrease in blood glucose was identified in diabetic patients receiving HBO2. Although rare, hypoglycemia did occur. Post HBO2 glucose monitoring is recommended in diabetic patients prior to discharge from the hyperbaric facility.

1045 Team Based Approach to Diabetes Care
Wilford Hall Medical Center (WHMC), Medical Wing (MDW), Lackland AFB, TX

Mark True, MD, Nina Watson, RN, CDE, Joseph Pollard, MPH, Acknowledgements: Linda Siminerio*, RN, PhD, Kristine Ruppert*, DrPH

INTRODUCTION: A team approach has repeatedly been shown to improve the quality of care for individuals with diabetes. The Diabetes Center of Excellence (DCOE) at Wilford Hall Medical Center (WHMC) serves as a military regional hub for the provision of quality programs and a specialty clinic with team-based care resources for patients. The DCOE team serves as a referral center for patients with diabetes not meeting clinical targets. RESULTS: Patients were seen at the DCOE between January and December 2009. Results are based upon data collected from patients with an initial A1c >6% and documented follow-up A1c (n=378). These patients showed an average A1c decrease of 0.67% (p=0.001). Patients with an initial A1c >7% (n=323) showed an average decrease of 0.84% (p=0.001); patients with an initial A1c >8% (n=238) showed an average decrease of 1.12% (p=0.001); and patients with an initial A1c >9% (n=134) showed an average A1c decrease of 1.62% (p=0.001). CONCLUSION: These results indicate that a team-based specialty diabetes clinic in a military facility has a positive impact on glycemia. Additional study is needed to evaluate the impact on other metabolic outcomes.

*affiliated with the University of Pittsburgh

1245 The Effect of Special Duty Subpopulations on the Prevalence of Secretive Behaviors in the USAF
United States Air Force School of Aerospace Medicine (USAFSAM)

Col Mary Brueggemeyer

In the USAF, special duty status is defined as FLY, PRP (Personnel Reliability Program) or SCI (Special Compartmented Information) related duties. It is used to designate mission critical populations upon whom the AF Medical Service (AFMS) can apply focused preventive efforts to maintain human performance and insure mission success. These special duty subpopulations differ in work culture and job stress that may influence the prevalence of secretive behaviors such as alcohol abuse, suicidality and partner/child abuse. Knowledge about the prevalence of secretive behaviors within these special duty subpopulations could help focus prevention efforts. The USAF NORTHSTAR Project uses an anonymous community assessment (CA) survey to measure secretive behaviors by base and special duty status, but does not stratify by special duty subpopulation. Using official USAF manpower allocations, bases with predominant special duty subpopulations were grouped together. The 2008 CA survey was analyzed using the special duty subpopulation groups. Results showed that aircrew bases (AC) were more likely to report alcohol problems than SCI bases (OR 1.64, CI 1.25-2.15, p= 0.002); PRP bases were more likely to report suicidal thoughts than AC bases (OR 2.33, CI 1.29-4.19, p=0.004) and SCI bases were more likely to report spouse emotional abuse than AC bases (OR 1.77, CI 1.19-2.65), p=0.004) or PRP bases (OR 1.34, CI 1.01-1.79, p=0.04). Special duty subpopulations are not homogenous. Knowledge of the risk and protective factors within these communities will improve prevention of secretive behaviors and reduce mission impact. Future CA surveys should stratify by special duty subpopulation.

1315 The Association between Mental Health and Cigarette Smoking in Active Duty Military Members
United States Air Force School of Aerospace Medicine (USAFSAM)/FEER RAM-X

Maj/Dr. Erich Schroeder

Despite an overall decrease in smoking in the armed forces, the prevalence of smoking in the military remains at approximately thirty-three percent. Previous research has shown an association between mental health status and cigarette smoking. This cross sectional prevalence study examined four specific mental health predictors and the outcome variable any smoking. The four specific mental health predictors include "needed further depression evaluation," "received mental health counseling," "perceived need for mental health counseling," and "depression or anxiety medical prescription." The outcome variable any smoking is defined as smoking one or more cigarettes in the past 30 days. The population included active duty military members serving in the United States Army, Air Force, Navy and Marine Corps. The data was collected during the 2005 Department of Defense Survey of Health Related Behaviors Among Active Duty Military Personnel, a component of the Defense Lifestyle Assessment Program. The sample size included 13,603 subjects. This study consisted of descriptive statistics, univariate analysis, and multivariate logistic regression analysis of the four mental health predictors and the any smoking outcome variable. Univariate analysis and multivariate adjustment showed the data to be reliable. These analyses also showed an association between the four mental health predictors and any smoking, but not necessarily that mental health predicted smoking. More research and analysis is required to better determine the association of mental health with smoking in this population. This research could help guide public health officials in the development of smoking prevention and cessation programs not only for the military population, but also for the population at large.

1345 The Association between Mental Health and Hypertension in the 2005 DoD Population Survey
United States Air Force School of Aerospace Medicine (USAFSAM)

Lt Col/Dr. Scott Zaleski

Major objectives within Healthy People 2010 include improving hypertension and mental health management of the American population. Cases of either diagnosis may be incompatible with military service even with optimum treatment. The Department of Defense regularly conducts a survey of health related behaviors among active duty military personnel. The 2005 DoD Survey was conducted to obtain information regarding health and behavioral readiness among active duty military personnel to assess progress toward selected Healthy People 2010 objectives.

This study is a cross-sectional prevalence design looking at the association of hypertension treatment with mental health issues (whether there is a significant association between the self-reported occurrence of hypertension and the self-reported occurrence of mental health issues in the 2005 DoD Survey). In addition to these variables, this survey examined the contribution of various sociodemographic, occupational, and behavioral covariates. An analysis of the demographic composition of the study variables was followed by logistic analysis, comparing outcome variables with each of the independent variables. Following univariate regression analysis, multivariate regression was performed with adjustment (for those variables with an unadjusted alpha level less than or equal to 0.25).

All the mental health related indicators were associated with hypertension treatment. The same relationship was maintained after multivariate adjustment. The covariates remaining as significant ($p < 0.05$) in the final model included gender, age, race/ethnicity and obesity. Optimum health of the individual can be facilitated through discovery of treatable cases, to minimize disruptions of military missions, and even allow for continued military service.

1430 Psychosocial Stress of RPA Operators
United States Air Force School of Aerospace Medicine (USAFSAM)

Aeromedical Psychologist Wayne Chappelle

USAF Remotely Piloted Aircraft (RPA) operators are placed in the unique position of engaging in around the clock "tip-of-the-spear" surveillance, reconnaissance, and precision strike aerial operations in theaters of conflict while simultaneously living at home and juggling the demands of their domestic life. This uniqueaspect of RPA operations has raised questions about the impact on the health of RPA operators. Research has found RPA operators to experience greater levels of fatigue in comparison to airborne aircrew (i.e., AWACS, JSTARS). Yet, concerns regarding negative changes in psychological health effecting performance and readiness are abundant. However, no empirical studies have been conducted to officially screen for PTSD, clinical levels of psychological distress, and other changes in psychological health. To fill the current gap, this study had RPA operators (pilots, sensor operators, and mission intelligence coordinators) from AFSOC, ACC, ANG, and Reserve MQ-1 Predator, MQ-9 Reaper squadrons complete standardized, commercial, questionnaires assessing the psychological health and levels of clinical stress diagnostic of a mental health

disorder (including PTSD). Comparisons were made between active duty, and national guard/reserve units.

This study provides key information on the prevalence of symptoms among such RPA operators and informs flight medicine physicians and operational leadership the extent of mental health services needed. This study provides a measure to gauge the extent of symptoms to best ensure that adequate resources are available to sustain the readiness of these airmen so they may continue to fly, fight, and win.

1500 Multivariate Analysis of MAB-II and MicroCog Neuropsychological Screening in Rated USAF Pilots
United States Air Force School of Aerospace Medicine (USAFSAM)

Maj/Dr. Bret Heerema

BACKGROUND: Intelligence testing and neuropsychological screenings have multiple uses in the selection and assessment of United States Air Force (USAF) pilots and pilot applicants. These tests are a critical part of USAF medical flight screening and aeromedical waiver procedures after neurological insult for aircrew. The purpose of this study is to assess the factorial structure regarding a measure of intelligence testing given to USAF pilot training applicants (manned as well as unmanned) during medical flight screening. Is the factorial structure of intelligence testing difference for such a specialized occupational group different from the general population? METHODS: Principal components analysis was conducted on the intelligence test scores from the Multidimensional Aptitude Battery-Second Edition (MAB-II) administered to 10,612 USAF pilot applicants selected for training. Subtest and measurement model correlations were also estimated. RESULTS: Neuropsychological screening consisting of the MAB-II suggests there are three correlated indices unique to the rated USAF pilot population in contrast to the two-factor measurement model of the general population. In addition to verbal intelligence quotient (IQ) and performance IQ factors, a visual processing speed IQ comprised of the arithmetic, digital symbol, and spatial score subtests is present in this population. Confirmatory factor analysis using this model of the MAB-II showed positive correlations between the factors and between specific subtests. CONCLUSIONS: There are significant differences between the general population and rated USAF pilots' intelligence test scores. The relationship of these scores must be well understood to effectively evaluate how other aptitudes are affected with changes in any particular subtest. Neuropsychologists should be sensitive to such differences and use population specific normative data in evaluating the cognitive disposition of rated USAF pilots. Further studies are needed to determine the role of these factors in performance in the pilot population leading to more accurate predictive cognitive aptitudes.

1530 Risk of Prostate Cancer in USAF Aviators
United States Air Force School of Aerospace Medicine (USAFSAM)

Col Marc Goldhagen

BACKGROUND: There have been several studies indicating elevated incidence of prostate cancers in aviators both in the civilian and military sectors. Some studies show an increased risk for cancer in aviators and some do not. These studies compare aviators with the general population and these two cohorts can differ substantially in terms of socioeconomics, health surveillance, and environmental exposures. We were interested in conducting a controlled study in which prostate cancer incidence was compared in aviators using a reference group which is more similar to the aviators. METHODS: This retrospective analysis compared incidence of prostate cancer between USAF aviation officers and non-aviation officers using the Automated Cancer Tumor Registry of the Department of Defense linked to personnel records from the USAF Personnel Center. RESULTS: Crude incidence ratios were compared to SEER data of the overall US population showed slightly lower incidence in USAF personnel. Kaplan-Mier survival curves showed no difference between the USAF aviators and non-aviators. Cox Proportional Hazards model also confirmed no difference between the two groups after controlling for age and race. DISCUSSION: This study showed no difference in prostate cancer incidence between USAF aviators and non-aviators. While the study included a relatively large sample size, limitations of the study include a young population group, in which low incidence would be expected.

ABSTRACTS

Enroute Care Track

Tuesday, 24 August 2010

1300 Optimal User Interface for Remote En-Route Care Patient Monitoring
CSTARS- Cincinnati

Richard D. Bucholz, MD

Introduction: The U.S. Army Medical Research and Materiel Command recommends operating rooms are developed that "design and test the optimal User Interface (UI) for surgeons, anesthesiologists, and nurses to input and access clinical data. The optimal UI will support multi-mode access, where clinicians are able to use mobile devices, internet browser access to intranets, and adequate remote access through secured internet connections." The Saint Louis University (SLU) Advanced Neurosurgical Innovation Center provides test-bed capacity to translate technology from bench to simulated test-bed, to the field. Methods: Multimodal technology developed at SLU (SLU, U.S. Pat No. 6,928,490) will provide a networking infrastructure to permit variable-bandwidth testing of medical device telemedicine in collaboration with existing USAF C-STARS simulation laboratory facilities at SLU. Results: (1) Create a shielded space manifested by a firewall-protected wired and wireless network, (2) Provide life support networked and controlled by the system, (3) Develop display devices to provide visualization for the surgeon as well as any other required participants to enable experts to remotely participate in a given intervention, (4) Enhance plasticity by removing cumbersome set-up tasks and allowing unprecedented connectivity between devices. (5) Allow rigorous documentation and archiving of all information generated within a continuum of care. Conclusion: This proposal will develop and test technology to integrate medical communication within a shielded environment, allow remote projection of medical and surgical expertise and control over variable bandwidth networks with secure encrypted remote command, and allow monitoring en route from far forward locations to the final definitive care facility.

1330 Vascular Injury Rates from the Wars in Iraq and Afghanistan
59th Medical Wing (MDW)/SSSOGV

Todd E. Rasmussen MD, Joseph M. White MD, W. Darrin Clouse MD, Gabriel E. Burkhardt MD, Adam Stannard MRCS, Brian J. Eastridge MD, Lorne H. Blackbourne MD

The Institute of Surgical Research, Fort Sam Houston, Texas and the Uniformed Services University of the Health Sciences, Bethesda, Maryland

OBJECTIVE: The rate of vascular injury in WWII, Korea and Vietnam was 2-3%; however, not since Vietnam has the epidemiology of this injury pattern in war been possible. This study objective is to report the burden of vascular injury over 7 years of recent combat. METHODS: The Joint Theater Trauma Registry was queried (2002-2009) for vascular injury in US Troops and groups defined. Group 1 (specific): Troops having sustained specific vascular injury and Group 2 (operative): Troops having undergone a designated operation for vascular injury. RESULTS: Group 1 included 1,597 Troops injured in Iraq (OIF) (n=1,417) and Afghanistan (OEF) (n=180). Mechanism included explosive (75%), gunshot (24%) and other (1%) with explosive more common in OIF than OEF ($p<0.05$). During this period, 13,076 battle related injuries occurred resulting in a specific rate of 12% (1,597/13,076) which was higher in OIF than OEF (13% vs. 9% respectively; $p<0.05$). Of Group 1, 60% (n=940) sustained injury to major or proximal vessels and 40% (n=630) to minor or distal vessels: categorized as arterial 64%, venous 16% or combined 20%. Group 2 comprised 1,212 Troops revealing an operative injury rate of 9% (1,212/13,076) and included ligation (n=660; 54%) or repair (n=552; 46%). The "died of wounds" rate was 6.2% in OIF and 7.2% in OEF ($p = 0.64$). CONCLUSION: The rate of vascular injury recorded in modern combat is 5 times previously reported. Differences in vascular injury burden related to theater of war, mechanism of injury and combat operational tempo can be discerned and anticipated.

1400 Direct Vascular Control Results in Less Physiologic Derangements than Aortic Crossclamping in a Porcine Model
Brooke Army Medical Center (BAMC) - Working with 59 Medical Wing (MDW)/SSSOGV

Capt Nick Markov

OBJECTIVE: Establishing vascular control during resuscitation in patients with end stage, non-compressible extra-thoracic torso hemorrhage remains debated. Currently, guidelines recommend emergency department thoracotomy (EDT) with aortic clamping although trans-abdominal aortic control and direct vascular control of the injury are potential alternatives. The objective of this study is to introduce an animal model of extra-thoracic torso hemorrhage and to compare the effectiveness of various methods of initial open vascular control. STUDY DESIGN: Animals (Sus Scrofa) (mean weight=80.9 kg) were randomized into 3 groups all of which had class III shock established via hemorrhage from an iliac artery injury prior to exploration with temporary vascular shunting. Group 1: EDT with thoracic aortic clamping (N=6), Group 2: intra-abdominal supra-celiac aortic clamping (SCC; N=6), and Group 3: direct vascular control (DVC) of bleeding site without aortic clamping (N=6). All groups were subsequently resuscitated and monitored for 6 hours with repeated measures of central perfusion, cerebral perfusion, and end organ function at standardized time points. RESULTS: There was no difference in mortality among the groups and no TVS failures. Central aortic pressure, carotid flow and trans-cranial brain oximetry all demonstrated increases in Groups 1 and 2 after application of the aortic clamp relative to Group 3 ($p<0.05$). During resuscitation, serum lactate levels were higher in Group 1 compared to Groups 2 and 3 (6.85 vs. 3.08 and 2.15, respectively; $p<0.05$) and serum pH in Group 1 reflected greater acidosis than Groups 2 and 3 (7.24 vs. 7.36 and 7.39, respectively; $p<0.05$). Groups 1 and 2 required significantly more intravenous fluid than Group 3 (2,166ml and 1,833ml, vs. 500ml respectively; $p<0.05$) and significantly more vasopressors were used in Groups 1 and 2 compared to Group 3 (52.1mcg and 43.5mcg vs. 10.3mcg, respectively; $p<0.05$). CONCLUSION: This study reports a novel model of non-compressible extra-thoracic torso hemorrhage comparing the effectiveness of EDT to SCC and DVC. Although EDT and SCC increased central and cerebral perfusion, DVC resulted in less physiologic derangement. Clinical studies evaluating DVC are warranted and require further investigation.

1445 Hemorrhagic Shock Worsens Neuromuscular Recovery in a Porcine Survival Model of Ischemia/Reperfusion Injury
59th Medical Wing (MDW)/SSSOGV

Capt Heather Hancock MD, Lt Cdr Adam Stannard MRCS, Jerry Spencer RVT, Capt Gabriel Burkhardt MD, LTC Todd Rasmussen MD: San Antonio Military Medicine Consortium, University of Texas Health Science Center at San Antonio, and the Uniformed Services University of the Health Sciences Bethesda, MD

BACKGROUND: Current pre-hospital damage control strategies have increased survival to surgical care, resulting in an increased burden of severely injured salvaged limbs and emphasis on the functional outcomes of salvaged limbs. The objective of this study is to characterize the additive effect of hemorrhagic shock in a novel porcine survival model of functional limb outcomes. METHODS: Groups of 6 animals were randomized to iliac artery repair after progressive times of ischemia. 35% total blood volume was removed at a controlled rate creating Class 3 shock. An earlier arm used the same groups without hemorrhage and was used for comparison. Animals were monitored for 14 days to serially collect markers of functional recovery. RESULTS: Immediate Iliac repair and 1 hour ischemia animals had full functional recovery by the end of the observation period with minimal histologic evidence of remaining muscle and nerve damage, equivalent to controls without hemorrhage. Following 3 hours of ischemia, functional recovery was delayed and impaired, with moderate to severe degeneration of nerves and muscle noted on histology. Animals undergoing 6 hours of ischemia with the addition of hemorrhage had minimal EMG response and suffered severe systemic inflammation. Histological outcomes demonstrated nearly complete muscle and nerve degeneration. Significant mortality differences were noted when comparing delayed reperfusion groups (3, 6, ligation) with early repair. CONCLUSION: Results suggest a detrimental impact on the ischemic threshold already defined in a non-hemorrhagic model. It is likely that this model more accurately represents the critically ill combat

casualty and as such will more reliably inform clinical practice.

1515 Quality of limb salvage following wartime extremity vascular injury: results of a novel patient-based outcomes study
UK Research Fellow Working with 59th Medical Wing (MDW)/SSSOGV

Adam Stannard, Gabe Burkhardt, Barbara Keltz, Chantel Porras, Rebecca Ivatury, Shaun Gifford, Todd Rasmussen, 59th Clinical Research Training Division, Wilford Hall Medical Center, 2200 Bergquist Drive , Bldg 4430, Lackland AFB, TX 78236-5300

BACKGROUND: As efforts are increasingly directed beyond statistical, to quality limb salvage, following extremity vascular injury, a patient-based outcomes measure is needed. The objective of this study is to describe a novel questionnaire, designed to assess quality of limb (QOL) in a cohort of combat wounded with limb threatening injuries. METHODS: Clinical records from the Joint Trauma Theatre System (JTTS) were reviewed for a cohort with extremity vascular injuries between 2002 and 2009. A 21-point questionnaire addressing limb outcome (limb status, pain, functional impairment, satisfaction with current limb) was completed. Patient responses were stratified on a 30-point scale with 0 representing the poorest limb quality. RESULTS: Contact was made with 104/256 (41%) of patients and survey responses for QOL questionnaire from 45 (45%). Eighty-seven percent (39/45) of respondents had lower limb injuries. Nine patients with lower extremity injury (23%) had an amputation and all could mobilize with a device. Lower limb salvage was 76% at 28 months, although 91% reported the extremity did not work normally (77% specifying pain with ambulation). Ninety-one percent report function adequate to enable walking; 53% required daily analgesia for their extremity injury and 32% report they would be better off having had an amputation. Six respondents had upper extremity injuries with no amputations, 100% reported neurologic disability; 1 respondent would have preferred amputation. Overall 48% of the cohorts were separated with disability benefits and 52 % remain active duty with a profile. CONCLUSION: Results from this study demonstrate that patient-based outcomes following extremity vascular injury are limited by secondary amputation, pain and neurologic dysfunction. A novel QOL questionnaire aimed to better characterize functional limb salvage may allow correlation between in-theater strategies and long-term function.

1545 Traveling Fellowship to the United Kingdom as an adjunct to general surgical research and training
59th Medical Wing (MDW)

Lt Cdr Adam Stannard

Military medical missions spanning two mature theaters of conflict require flexible deployment of personnel and resources. International collaboration with allies operating in established facilities in Iraq and Afghanistan generates synergy in patient management, resource utilization, and research development. The impact of these relationships on the education of future physicians and surgeons has not previously been described. The objective of this traveling fellowship is to describe the utility of a brief structured orientation to military medicine and research within the United Kingdom.

Between 12 April and 14 May 2010, as a senior general surgical trainee, I participated in an exchange with the United Kingdom under the mentorship of several senior UK military consultants. In addition to presenting our group's research at two international meetings, I was invited to participate in the Military Operational Surgery Training (MOST) course. I completed a structured observership at the Royal London Hospital which included exposure to physician driven pre-hospital health care delivery, and operative management of trauma at a level I facility. Injured UK troops recovering at the leading military rehabilitation center in the UK (Headley Court) were interviewed, as were physicians involved in their care to describe functional limb salvage using patient based outcomes measures.

A brief structured exchange within the UK military medical system serves as a productive and meaningful adjunct to my military medical education. Research collaboration with respect to quality of limb outcomes may enable a more comprehensive assessment of the impact of surgical interventions following severe extremity injuries.

Wednesday, 25 August 2010

0800 Enhancement in Communication of Performance Improvement Events within a Global Military Trauma System
Landstuhl Regional Medical Center

Kathleen Martin

LRMC is the first military hospital outside the combat zones of Iraq (OIF) and Afghanistan (OEF) and concurrently indentifies performance Improvement (PI) events/ complications (E/C) related to downrange, enroute, and interfacility care. E/C identified in transit between OIF/OEF-LRMC-USA for evacuees accompanied by Critical Care Air Transport Teams (CCATT) are referred to the CCATT Pilot Unit. Aeromedical (AE) E/C are referred to the Air Force AE system PI Director, enhancing communication between ground and flight providers. Urgent issues are communicated verbally and weekly aggregate reports are sent to Joint Theater Trauma System (JTTS) downrange, CCATT and AE liaisons. In 2008, 1230 patients arrive to LRMC; 313 via CCATT and 724 via AE. PI E/C were captured concurrently and entered in the trauma registry by the Trauma Coordinators. There were 148 (12%) E/C identified and referred to JTTS; 28 (5%) to CCATT: 15 (<1%) to AE. In 2009, 1191 patients arrive to LRMC; 299 via CCATT and 813 via AE. There were 337 (28%) E/C identified and referred to the JTTS; 34 (7%) to CCATT; 11 (<1%) to AE. Communication of E/C occurred daily via secure DSN phone lines, encrypted email and video-teleconferencing. Communication of PI E/C is a challenge due to varied provider demographics, multi-service/national providers, distance across 3 continents, and in the complexity of effective PI. LRMC is the epicenter for bidirectional communication and utilizes technology, trauma PI/registry taxonomy in all interfaces despite distances and diversity, to leverage enhancements. This is an ideal arena to employ a true inclusive trauma system.

0830 Local Hemostatic Agents in a Survival Model of a Lethal Porcine Liver Injury
86th MDS

Maj/Dr. Bradley Putty

Rapid control of bleeding presents a major challenge in the severely injured trauma patient who may present with hypothermia and coagulopathy. Uncontrolled bleeding is the leading cause of combat-related death. The liver is the most commonly injured solid organ, and high grade injuries are difficult to treat. When the bleeding is resistant to standard techniques of control, the surgeon may be aided by the use of advanced topical hemostatic agents. The long term efficacy and safety of using such materials on the liver is unknown.

A survival model of a lethal liver injury in swine was employed to test commercially available advanced hemostatic agents against standard gauze dressing to determine if their use results in a durable decrease in blood loss and mortality. Following induction of hypothermia and a controlled 35% hemorrhage, the animals received a standardized grade IV liver injury. They were randomized to receive packing with plain gauze either alone or with a hemostatic agent (Celox(tm), Celox(tm) Gauze, or QuikClot® COMBAT GAUZE(tm)-the only topical hemostatic currently approved in-theater), with blood loss measured after 15 minutes and 2 days at repeat operation. Observation continued for two weeks before sacrifice with histologic evaluation for delayed effects on the liver and other major organs.

Of the agents tested, Celox(tm) and Celox(tm) Gauze were associated with the greatest 48 hour and 2 week survival, while Combat Gauze(tm) was associated with the highest mortality at 48 hours and 2 days. Celox(tm) appears to be associated with adhesion formation.

0900 Affect of Altitude on Extremity Compartment Syndrome (ECS)
United States Air Force School of Aerospace Medicine (USAFSAM)/FEEH

Dr. John Kalns

INTRODUCTION: ECS is believed to be exacerbated by hypobaric conditions during AE evacuation but scientific evidence supporting this claim does not exist. METHODS: ECS was initiated in the pig by placement of a balloon

catheter between the tibia and the tibialis anterior muscle of the hind limb. Inter-Compartmental Pressure (ICP) greater than Mean Arterial Pressure was maintained for 5 or 6 hours and then reduced and pigs monitored for 8 hours. In some cases pigs were exposed to hypobaric conditions equivalent to 7,000 feet elevation after injury. RESULTS: After injury ICP's increased for 2 hours and then stabilized at an elevated value associated with ECS. Five hour injury (n=10) produced ICP's that meet compartment syndrome criteria, MAP-ICP< 45 mm-Hg, 30% of the time whereas 6h injury (n=10) produced ECS criteria 100% of the time. This finding suggests that there is a critical threshold for ECS. Histological assessment of muscle demonstrated edema, necrosis and extensive neutrophilic infiltrate in limbs with elevated post-injury ICP's. Immunohistochemistry showed the presence of the redox stress product 3-nitrotyrosine in severely injured muscle. Myoglobin in plasma was elevated 10- fold in pigs that experienced increased ICPs. Altitude exposure after injury has no effect on ICP or muscle pathology. Inflammatory cytokines are elevated however. Conclusion: We have shown that ECS with features similar to those observed in AE patients can be produced in the pig. Future studies will examine the impact of hemorrhage/resuscitation and pharmacologic agents on ECS in the AE environment.

0945 Bacterial Growth at Altitude

United States Air Force School of Aerospace Medicine (USAFSAM)/Center for Sustainment of Trauma and Readiness (CSTARS); Cincinnati, OH

Capt Ryan Earnest

OBJECTIVES: Bacterial growth is a known risk factor for tissue loss and complications in contaminated musculoskeletal wounds. Current care for these casualties includes strategic aeromedical evacuation. The effect of altitude on bacterial growth in contaminated complex wounds is unknown. We hypothesized that exposure to hypobaric hypoxia alters bacterial growth in contaminated complex musculoskeletal wounds. METHODS: We adapted a previously characterized caprine model. Under anesthesia, complex musculoskeletal wounds were created and inoculated with bioluminescent *Pseudomonas aeruginosa*. At 20 hours post surgery and inoculation, goats (n=5) underwent simulated aeromedical evacuation for seven hours at 8800 feet in a hypobaric chamber. Controls (n=5) were transported without flight simulation. Bacteria were quantified using photon counting at preflight (20 hours post surgery), post flight (7 hours from preflight and 27 hours post-surgery), and necropsy (24 hours from preflight and 44 hours post surgery). Results are expressed as Relative Luminescent Units (RLU) normalized to each goat's pre-flight baseline value. Statistical analysis was performed with Mann-U-Whitney test with $p<0.05$ deemed significant. RESULTS: There were no deaths in either group. Each group demonstrated increasing RLU values over time (Figure 1). Goats undergoing simulated aeromedical evacuation demonstrated increased mean RLU values as compared to control animals at the post flight and necropsy time points. CONCLUSION: In the current study, simulated aeromedical evacuation resulted in increased bacterial luminescence in a contaminated complex wound. These findings are important because they suggest that hypobaric hypoxia during aeromedical evacuation may accelerate bacterial growth in contaminated wounds.

1015 Technical Evaluation of Enroute Care Mechanical Ventilation

United States Air Force School of Aerospace Medicine (USAFSAM)/Center for Sustainment of Trauma and Readiness (CSTARS); Cincinnati, OH

SMSgt Dario Rodriguez, Jr.

INTRODUCTION: Mechanical ventilation in far forward military operations requires a device that is consistent, light weight and easy to use. We evaluated the SAVe (simplified automated ventilator) in a laboratory setting to determine performance characteristics. METHODS: Three SAVe resuscitators were tested. Each was attached to a test lung with volume, pressure, and flow measured with a pneumotachometer. Compliance and resistance of the test lung were varied to simulate varying patient conditions. Oxygen was entrained at the inlet and FIO2 was measured with a fast response oxygen analyzer at the airway. All measurements were made at sea level, 4000, 8000, 12,000, and 18,000 feet. Battery life was measured twice with each device by operating it to exhaustion. RESULTS: Delivered tidal volume and inspiratory time varied when changing lung model conditions as well as between devices within the same lung model condition at sea level and at altitude. The largest reduction in tidal volume was at the lowest compliance. Measured FIO2 was comparable to

reported FIO2 although it decreased with simulated spontaneous breathing through the device. CONCLUSIONS: The SAVe resuscitator is a limited function device. Tidal volume delivery is inconsistent with decreased lung compliance and/or increased resistance. The set respiratory rate and tidal volume are not guaranteed under these conditions. During spontaneous breathing, room air is supplied to the patient. The SAVe could potentially be used for ventilatory support of carefully selected military casualties to replace manual ventilation, but caregivers must be aware of the limitations.

1045 Joint Medical Distance Support and Evacuation (JMDSE), Joint Capability
United States Joint Forces Command (USJFCOM)-J02M

CDR Greg Cook

The United States Joint Forces Command (USJFCOM) is conducting the Joint Medical Distance Support and Evacuation (JMDSE), Joint Capability Technology Demonstration (JCTD) to enable precise logistical delivery of critical, mission specific medical equipment and supplies to include telemedicine, digital patient encounter documentation, and transmission capabilities for medical first responders. These enhanced capabilities will be air-dropped by Joint Precision Airdrop Systems (JPADS) from manned and/or Unmanned Aerial Systems (UAS) to augment and extend in-place combat casualty care within forward Army, Marine Corps and Special Operations ground forces, Air Force Para-rescuers, and Navy ships/submarines with limited organic medical support. Within these combatant organizations, medics or corpsmen will be provided an on-demand capability to capture and transmit digital physiological monitoring data (i.e. blood pressure, pulse, temperature, respirations, ECG, ECO2, SP02, ventilator treatment, data elements common to the Tactical Combat Casualty Care and Field Medical Cards), and digital voice recordings of patient encounters to enable immediate telementoring and to facilitate accurate, complete point-of-injury data within permanent medical records. A set of ruggedized equipment and a lightweight digitally enabled physiological monitoring system are being integrated with military radios and soldier headset voice data capture technologies, and will be packaged for just-in-time air delivery via JPADS. A series of three 2010-11 Operational Demonstrations involving with land, air and maritime forces will be used to determine the utility of JMDSE capabilities. We discuss the technologies employed, the operational scenarios and results of the first series of exercises.

1245 Field Intravenous Fluid Reconstitution (FIVR)
Air Combat Command (ACC)/SGR, Langley AFB, Hampton, VA

LtCol Steven Stern

The objective of the FIVR project is to develop a Food and Drug Administration (FDA) approved device consisting of integrated medical components capable of producing packaged intravenous fluids for use by medical personnel in field locations. FIVR shall be capable of being employed at forward resuscitative care (or higher) deployed medical treatment facilities to provide initial resuscitative and surgical medical care to stabilize patients for evacuation to a higher level of care.
The FIVR device shall produce FDA approved IV solutions to include normal saline, half normal saline, dextrose 5% with normal saline, and lactated ringers at deployed locations for immediate use or storage. A pre-filter shall condition potable water to Environmental Protection Agency (EPA) quality where the FIVR device shall have the capability to condition the incoming water temperature; a function to sterilize the water suitable for injection; and an automated methodology to fill chemical pre-loaded bags to produce packaged intravenous solutions.
A FIVR device will culminate with FDA approval and will enhance capability reducing the medical logistical footprint and lift requirements. This operational outcome will facilitate essential care in theater and enhance care during contingencies. This capability is needed to decrease the risk of not having sufficient intravenous fluids available at deployed locations and reduce the logistical footprint (lift, storage, and waste) associated with the current operations requirement.

1315 A comparison of proximal tibia, proximal humerus and distal femur infusion rates under high pressure using the EZ-IO Intraosseous device on an adult swine model
59th Medical Wing (MDW)

Maj Julio Lairet

OBJECTIVES: Compare the intraosseous flow rates of the proximal tibia, distal femur and the proximal humerus using high pressure (>300 mmHg) in an adult swine model. METHODS: A 25mm EZ-IO needle was inserted into the proximal tibia bilaterally of eleven swine, and a 45mm needle was inserted into the distal femur and proximal humerus bilaterally. Intravascular volume was removed until the mean arterial pressure was decreased to 25% from baseline. Infusion of normal saline was carried out at each site for a period of 10 minutes with a pressure bag at highest achievable pressure (> 300 mmHg). At the end of 10 minutes infusion rates were calculated. Following euthanasia the bone IO insertion sites were harvested by the veterinary pathologist for histopathologic examination. Statistical analysis was performed using ANOVA. RESULTS: The mean infusion pressure for the tibia was 580 mmHg, 553 mmHg for the femur and 499 mmHg for the humerus. Comparing the infusion rates of the humerus (213 mL/min) to the tibia (138 mL/min) revealed a $p<0.001$. When comparing the humerus (213 mL/min) to the femur (138 mL/min); $p< 0.001$. Comparison between the tibia (103 mL/min) and the femur (138 mL/min) did not reveal statistical significance $p<0.138$. Histopathologic examination revealed minimal to mild subperiosteal and/or periosteal hemorrhage adjacent to where the intraosseous needle was inserted.

Conclusion: The rate of infusion was greater via the humerus route compared to the tibia and the femur. Additional studies are needed to further evaluate high pressure infusions (>300 mmHg) using intraosseous devices.

1345 Inflammation Following Hemorrhage and AE
United States Air Force School of Aerospace Medicine (USAFSAM)/Center for Sustainment of Trauma and Readiness (CSTARS); Cincinnati, OH

Tim Pritts, MD, PhD

OBJECTIVES: Hemorrhage is the leading cause of potentially preventable mortality in current military conflicts and is associated with acute inflammation. Improved resuscitation strategies are necessary for optimal outcomes, but the effect of hypobaric hypoxia on the inflammatory response to hemorrhage and resuscitation is unknown. We hypothesized that exposure to hypobaric hypoxia may alter the acute inflammatory response. METHODS: Mice underwent femoral artery cannulation and hemorrhage using a pressure-clamp model, then resuscitation with Lactated Ringer's solution (LR) or a 1:1 ratio of fresh packed red cells and plasma from donor animals (1:1). At 1 and 24 hours following resuscitation, mice underwent simulated shock in mice. These findings suggest that the current practice of aeromedical evacuation following injury, including rapid transport to higher echelons of care, may not negatively impact the inflammatory response following hemorrhage.

1430 MAF Aircrew Fatigue Countermeasures Survey
United States Air Force School of Aerospace Medicine (USAFSAM)

Col/Dr. Jane Karen Klingenberger

No Go Pills (hypnotics) have been available to aircrews for several years for use in operational settings; however, to date there has been no assessment of their efficacy. Are Mobility Air Force (MAF) aircrews effectively utilizing pharmaceuticals that enhance sleep (hypnotics) to count the effects of "jet lag" and other operational disruptors including circadian rhythm?

Currently there are three hypnotics that are ground tested and approved for all MAF aircrews. The presentation will be a review and discussion based on a new aircrew survey and the results of a convenience sample of respondents assessing the self reported frequency and effectiveness of "No Go" medication use.

Preliminary data suggests that 40%-50% of MAF aircrews are using "No Go" medication while TDY or on overseas missions with a statistically significant difference in the length of sleep.

Force Health Protection Track

ABSTRACTS

Tuesday, 24 August 2010

1300 A Novel Approach to Zoonotic Population Health Monitoring: The Zoonoses Integration Project

82nd AMDS

Maj Thomas Doker

Zoonotic diseases comprise most of the pathogens that currently cause human disease and are potential bioterrorism and emerging infectious disease agents. Delays of various lengths can occur between initial diagnosis and reporting to local public health systems with traditional passive disease reporting. Animal reservoirs, vectors, and hosts create a multifaceted epidemiology. Environmental factors resulting from weather and geological events, human interactions, and habitat modifications affect the populations of animals within zoonotic disease chains of infection.

The Zoonoses Integration Project (ZIP) was designed to be a component of a fusion center that assimilated public health studies, general media sources, and other sources to generate a daily SA report. Many public health administrators do not have the time nor the expertise to gather information which provide the SA they require on a daily basis. Moreover, disease events in other countries can rapidly become global public health concerns.

ZIP provided linkage of pathogen selections to diseases and provided an effective way for listing existing subtypes. Options are recommended for selecting reservoir, vector, and host species. Daily multidisciplinary meetings were important for assessing the reliability, validity, and significance of collected data. More research is needed to determine the biosurveillance needs of decision makers and to evaluate the effectiveness of any public health action that occurs due to the receipt of timely and quality biosurveillance reports.

1330 Hydroxocobalamin and Epinephrine Each Improve Survival in a Novel Swine Model of Cyanide-Induced Cardiac Arrest: A Randomized Trial

59th Medical Wing (MDW)

Maj Vik Bebarta

INTRODUCTION: Hydroxocobalamin (HOCB) is a cyanide (CN) antidote, but it has not been studied in CN-induced cardiac arrest. In addition, a clinically relevant model for drug or chemical induced cardiac arrest has not been described. HYPOTHESIS: Our primary hypothesis was that HOCB will improve survival compared to controls in a CN-induced cardiac arrest swine model. METHODS: 45 swine were intubated and instrumented and then cyanide was infused until cardiac arrest. Animals were randomly assigned to HOCB, EPI, or saline bolus. CPR was performed with a chest compression device. Vasopressor infusion (epinephrine) was used after ROSC for SBP < 90 mm Hg. RESULTS: At 2 and 4 min after arrest, coronary perfusion pressures were greater than 15 mm Hg in treatment groups. All (15) animals in the control group, 4/15 in HOCB group, and 4/15 in EPI group died ($p < 0.001$). ROSC at 5 min and 10 min were similar in treatment groups ($p > 0.9$). Vasopressor infusion after ROSC was required for hypotension in 2/11 HOCB animals and in 11/11 EPI animals ($p < 0.001$). At 60 min, serum lactate (4.9 vs. 12.1, $p<0.0001$) and pH (7.34 vs. 7.153 $p<0.0001$) improved in the HOCB group. Serial serum CN levels in the HOCB group were lower after arrest until study end ($p<0.004$). CONCLUSIONS: HOCB and EPI both improved survival compared to controls in this swine model of cyanide induced cardiac arrest. HOCOB improved blood pressure, pH, lactate, and cyanide levels, and reduced epinephrine infusion use compared to the EPI group.

1400 Cold Injury in Military Population: Current Trends and Comparison to Past Conflicts with Current Research
59th 81 MSGS/SGCQ

Capt Andrew Hall

OBJECTIVE: The war in Afghanistan represents the first large-scale conflict involving military troops in a cold, mountainous climate since the Korean War. An analysis was conducted to identify the extent of cold weather injuries, especially frostbite, in the deployed military population. DESIGN: A retrospective analysis of military databases was conducted with tabulation of all cases of cold weather injuries in Operations Enduring Freedom and Iraqi Freedom. Casualties reviewed occurred between 2001 and 2009. RESULTS: A total of 19 cases of cold weather injury were identified in the Afghanistan conflict. 2 cases of frostbite were identified with only one likely requiring surgical intervention. No cases were identified in Iraq. CONCLUSIONS: The 19 cold weather injuries represents a dramatic decrease from the 6300 cases of cold weather injury seen in the last major cold weather conflict, the Korean War. This is due to the shorter and weather dependent engagements, cold weather education, and improved equipment of US and allied personnel. Discussion of research into angiogenesis using omental lipids for the treatment of frostbite and wound healing will also be discussed.

1445 The Association between Stress and Physical Fitness Testing in the 2005 Department of Defense Population Survey
United States Air Force School of Aerospace Medicine (USAFSAM)

Lt Col/Dr. Valerie Johnson

OBJECTIVE: The purpose of this study was to examine the association of perceived stress and passing the fitness test in a cohort of Department of Defense active duty members. Reports of this association have been suggested in numerous articles. METHODS: The 2005 DoD Survey of Health Related Behaviors Among Active Duty Military Personnel was used to examine the association between the participants' perceived levels of stress from family and/or work related sources and the respondents' last required fitness test taking into account potential confounder of the association. Measures of association were obtained from logistic regression models. RESULTS: Participants who experienced "some" or "a lot" of stress either from work sources (OR 0.69, 95% CI: 0.58-0.87) or from personal/family sources (OR 0.70, 95% CI: 0.57-0.86) were less likely to pass the fitness test when compared to their counterparts who experienced "none" or "a little" stress. Additionally, those who reported "some" or "a lot" of stress either from work sources (OR 0.54, 95% CI: 0.41-0.70) or from personal/family sources (OR 0.54, 95% CI: 0.44-0.67) that interfered with their military duties were also less likely to pass the fitness test. The multivariate adjustment only slightly reduced the unadjusted association. CONCLUSIONS: An association exists between perceived stress levels and outcome of fitness testing. The higher the level of stress perceived, the less likely the member will pass the fitness test. Stress-related intervention might be useful to help the military members to achieve the level of fitness needed to perform their duties.

Approved for public release; distribution is unlimited. 311 ABG/PA No. 10-202, 25 May 2010.1515

1515 The Error Rate of the Pushup Component of the USAF Fitness Assessment
19th Medical Operations Squadron (MDOS), Little Rock AFB, AR

Maj Eric Wilson

PURPOSE: To determine the Error Rate (ER) of the pushup component of the USAF Fitness Assessment. Numerous changes have recently occurred to the USAF's fitness program. With failure rates rising steadily, there is no reliability data to date on the test's most disputed content area. METHODS: Eight videos were made, each showing an individual performing one minute of maximum pushups while wearing one of the USAF fitness uniforms: t-shirt, long-sleeved shirt, sweatshirt, and jacket. Two videos were made for each subgroup. Ninety-two subjects undergoing PTL training (initial n=52; refresher n=40) viewed each of the eight videos once in random order and recorded the correct number of pushups performed. The Fitness AFI for pushup testing was read prior to viewing the videos. The primary investigator assessed the correct number of pushups by viewing the videos at ¼-speed with a grid overlapping the screen to assess elbow angles. RESULTS: ER was calculated for each subgroup (Mean, Standard Deviation, Range). The ER exceeded the number of pushups correctly performed in every subgroup. DISCUSSION: A trend in over-counting correct pushups was observed. Clothing had a significant effect on subject accuracy with t-shirts demonstrating the lowest ER compared to other subgroups. Exercise cadence, clothing variations, training and operational definitions are error sources contributing to the current grading criteria's inconsistent implementation. Air Force training should emphasize performance and recognition of appropriate form and a "tie goes to the runner" approach for testing.

Future considerations include redefining the operational definition and allotted time for the pushup test.

1545 Effects of sit-up training versus core stabilization exercises on sit-up performance: A cluster randomized trial
US Army-Baylor Doctoral Program in Physical Therapy

Lt Col John Childs, Deydre S. Teyhen, Timothy M. Benedict, Jamie B. Morris, Andrew D. Fortenberry, Rene M. McQueen, Jane B. Preston, Alison C. Wright, Jessica L. Dugan, Steven Z. George

PURPOSE: Core stabilization exercises target abdominal and trunk muscles without the excessive loading that occurs during sit-ups. However, core stabilization exercise programs (CSEP) have not been widely adopted in the U.S. Army because of the perceived deleterious impact they would have on performance during the Army Physical Fitness Test. The purpose was to determine whether performing CSEP in lieu of sit-ups during physical training would have detrimental effects on sit-up performance and passing rates on the fitness test. METHODS: Soldiers (N=2616) between 18-35 years of age were randomized to receive a traditional exercise program (TEP) with sit-ups or CSEP. Subjects with a previous history of low back pain or other injury precluding participation in training were excluded. Training programs were completed four times per week over 12 weeks. Performance was assessed at baseline and 12 weeks. RESULTS: Both groups demonstrated significant improvements in sit-up performance and overall fitness scores over time ($P<0.001$). There was no significance between group differences in overall fitness scores ($P=0.142$) or sit-up performance ($P=0.543$). However, CSEP resulted in a significant improvement in sit-up passing rates by 5.6% compared to 3.9% for the TEP group ($P=0.004$). CONCLUSION: There was a small but significantly greater increase in sit-up pass rate in the CSEP (5.6%) versus the TEP group (3.9%). Incorporating CSEP into Army physical training does not increase the risk of suboptimal performance on the Army's fitness test and may offer a small benefit for improving sit-up performance.

Wednesday, 25 August 2010

0800 Embedded Fragments - A Unique Exposure Situation and Concerns of Possible Health Effects
Armed Forces Institute of Pathology

Jose A. Centeno

BACKGROUND: The majority of modern war wounds are characterized by high-energy blast injuries containing a wide range of retained foreign materials of a metallic or composite nature. Health risks of retained fragments such as local or systemic toxicities, and delayed outcomes such as foreign body reactions or malignancies, are dependent of the chemical composition of the fragments and need to be further understood. Information obtained by chemical analysis of excised fragments can be used to guide clinical decisions regarding the need for fragment removal, to develop therapeutic interventions, and to better manage potential future medical problems arising from retained fragment related injuries. OBJECTIVES: The objective of this study is to define the chemical composition of retained embedded fragments removed from injured military personnel, and to relate results to histological findings in tissue adjacent to fragment material. RESULTS: Most fragments were obtained from penetrating wounds sustained to the extremities, particularly soft tissue injuries. The majority of the fragments were composed of single metals such as iron, copper, and aluminum with traces of antimony, titanium, uranium, and lead. CONCLUSIONS: The present study provides a systematic approach for obtaining a full chemical characterization of retained embedded fragments. Given the vast number of combat casualties with retained fragments, it is expected that fragment analysis will have significant implications for the optimal short and long-term care of wounded service members.

0830 The Evaluation of Nanoparticles as Biological Decontaminants
United States Air Force School of Aerospace Medicine (USAFSAM)/PHT, Brooks City Base, TX

Clarise R. Starr, PhD, George F. Viale, MSgt, USAF, NCOIC, Linda S. Armstrong, MS, Manuel Y. Caballero, BS, and David L. Maserang, PhD

Nanoparticles are insoluble particles that are no greater than 100 nm in size and are reported to have various electronic, magnetic and optical properties associated with them. Recent studies have demonstrated the unique anti-microbial and toxin neutralizing potential of these particles. The objective of this study is to find a universal nanoparticle formulation that is capable of killing Gram positive, Gram negative and spore forming bacteria and viruses, thus providing a potential alternative as a decontaminating solution in hospitals and laboratories, and have the ability to neutralize two common biothreat toxins, C. botulinum A and Staphylococcus enterotoxin B. This research has 3 specific aims: 1) To test a series of commercially based nanoparticle solutions (AgO, MgO and ZnO) with and without halogenation in liquid, powder, and gel matrices in order to find the top 4 solutions that can work on all 4 microorganisms and 2 toxins. 2) To test the top 4 formulations against various clinical and environmental matrices and surfaces to determine strengths and limitations and 3) To further test the safety of these formulation against established assays for possible deleterious effects against the end-user, if any, by established cell culture toxicity studies. This study utilizes commercially available nanoparticle reagents

that could be modified to work effectively as a universal decontaminant solution that is safer and less caustic than most off-the-shelf alternatives, such as bleach and in the case of anthrax decontamination, chlorine dioxide gas. The ideal solution would be easy to transport, safe for the end-user to manipulate with minimal protective gear, and effective against bacteria, viruses, and toxins in a short contact time.

0900 Toxicology & ESOH Issues of Engineered Nanomaterials
711th Human Performance Wing (HPW)/RHPA

Saber Hussain, Laura Braydich-Stolle, Nicole Schaeublin, David Mattie

Recent developments have generated a degree of apprehension concerning potential environmental, safety and occupational health (ESOH) risks associated with new, engineered nanomaterials. We are conducting focused research to establish the possible effects of nanoparticle exposure on biological systems. There are a great variety of physiochemical properties such as size, shape and surface chemistry of nanoparticles, which can contribute to nanotoxicity and this makes the safety assessment a challenging problem. We have established a lung co-culture model that simulates the human lung environment to evaluate the respiratory toxicity of nanoenergetic materials. We have demonstrated that there is a size dependent toxic effect of silver and silica nanoparticles, while in terms of gold nanotoxicity size, charge, and shape were mediating factors. When keratinocytes were exposed to gold nanospheres and rods, the rod shaped gold induced more toxicity. Furthermore, charged gold nanoparticles induced apoptosis, while neutral gold nanoparticles did not. Additionally, studies with nanoenergetic aluminum have demonstrated that at low levels of exposure there was little toxicity in the lung co-cultures, however, the immune cells ability to respond to bacterial pathogens was reduced. Taken together, all of these nanotoxicity studies demonstrate that there are multiple parameters that will contribute to how nanomaterials interact with a biological system and it is imperative to characterize these materials in order to fully understand the biological responses. The main focus of this presentation will be to discuss basic research applied to discover biological interaction of nanomaterials and its relationship to potential human health concerns.

0945 Evaluation of Jet Fuel Inducted Hearing Loss in Rats
711th Human Performance Wing (HPW)/RHPA

David Mattie, PhD

Noise-induced hearing loss (NIHL) continues to be a major military operational problem as well as a general occupational health hazard. Twenty-eight-day studies with male and female rats were designed to study the combined JP-8 jet fuel and noise effects on hearing loss. The first study was a baseline study for creating noise levels similar to occupational exposure. Rats were exposed to 0, 75, 85 or 95 dB for 6 hours per day, 5 days per week over 4 weeks. The second study will be an occupational exposure to noise combined with JP-8 to investigate the combined effects of jet fuel and noise on hearing loss. For noise exposure, audio editing software was used to filter and equalize a white noise file to one octave-band wide, centered at 8 KHz. The signal was split into three equalizers and amplifiers for producing the three noise levels generated using electrodynamic shakers mounted to the exposure chambers. In the first noise-only study, hearing loss was tested by performing the distortion product otoacoustic emission (DPOAE) test used to evaluate hearing function and the compound action potential (CAP) test to determine hearing threshold. Following the hearing assessment, microscopic examination of tissue in the cochlea of the inner ear was conducted to determine the percentage of hair cell receptor loss. All data from the first study showed significant effects on hearing at 95 dB with little or no effects at 75 dB, thus supporting the use of 85 dB for subsequent noise exposures.

1015 Toxicity and Health Hazard Assessment for Synthetic Paraffinic Kerosene
711th Human Performance Wing (HPW)/RHPA

David Mattie, PhD, John Hintz, PhD

The U.S. Air Force is pursuing the development of alternative fuels. One jet fuel, designated as Synthetic Paraffinic Kerosene (SPK), is produced from natural gas using the Fischer-Tropsch (F-T) process. The toxicology experimental results for SPK showed that dermal irritation was slight to moderate and genotoxicity studies were negative. Results for the acute inhalation study, in which male and female rats were exposed to 2000 mg/m3 for 4 hours, revealed no abnormal clinical observations. In the two-week range finder study, male and female F344 rats were exposed for 6 hours per day, 5 days per week to an aerosol-vapor mixture of jet fuel (0, 500, 1000 or 2000 mg/m3). Based on results of the two-week study, male and female F344 rats were exposed for 6 hours per day, 5 days per week for 90-days to an aerosol-vapor mixture of 0, 200, 700 or 2000 mg/m3 SPK jet fuel. Histological findings in the nasal cavities were minimal (700 mg/m3) to mild (2000 mg/m3), while only the high dose (2000 mg/m3) produced multifocal inflammatory cell infiltration in rat lungs (both sexes). The 50% respiratory depression (RD50) value from the sensory irritation inhalation study was calculated to be 10,939 mg/m3. In a comparative health hazard assessment (HHA), these SPK results were compared to JP-8. SPK appeared moderately less toxic or irritating than JP-8 under similar exposure conditions. An Occupational Exposure Limit (OEL) for SPK was

proposed to be 200 mg/m3, which is the current limit set for JP-8. Supported by AFMC 77 AESW/LF.

1045 Cellular Bioeffects Thresholds for Terahertz Frequency

711th Human Performance Wing (HPW)/RHDR/AFRL 8262 Hawks Rd, Brooks City-Base, TX 78235

Gerald Wilmink, DRII/Biomedical Engineer

The Terahertz (THz) region of the electromagnetic (EM) spectrum is defined as frequencies ranging from 0.1 to 10 THz. Historically, few sources have been available for this region; however, in recent years, several advances have been made in THz source development. Such advances have enabled numerous "real world" applications. For instance, THz techniques are now being used for security purposes to identify concealed explosives, drugs, and weapons. However, despite efforts to develop these applications, the bio-effects associated with THz radiation are not well characterized.

In this study, we used computational and empirical approaches to investigate the biological effects associated with THz radiation at a tissue, cellular, and molecular level. To examine THz-tissue interactions we conducted the following: (1) Developed THz-spectroscopy system to measure the optical properties of biological tissues; (2) Determined tissue-damage thresholds (ED50) using a Free Electron Laser and a molecular pumped THz source; and (3) Developed computational modeling algorithms to predict dosimetry and damage thresholds.

To examine THz-cellular effects we conducted the following: (1) Developed computational models to predict dosimetry and cell death-thresholds for THz-exposed cells; (2) Empirically determined cell-death thresholds using a THz laser, infrared camera, MTT assays, flow cytometer, confocal laser scanning microscope, and several adherent and suspension cell lines (e.g. Hela, NHDF, Jurkat).

Last, to examine THz-biomolecular effects, we used molecular dynamics modeling and empirical approaches. Specifically, we used genomic and transcriptomic analysis techniques (microRNA/mRNA microarray gene chips and qPCR) to characterize the cell's molecular response to THz radiation.

1245 Development of a Health-Belief-Model-Based Instrument to Assess Worker Beliefs about using PPE

Utah Air National Guard

LTC Jack Wall

Occupational illness is an identified problem in the United States Air Force (USAF). Of the many occupational illnesses reported annually, most are preventable through the use of personal protective equipment (PPE). The purpose of this study was to develop an instrument to assess the significance of the determinants that predict the use of PPE in small industrial USAF shops. The focused aim of the study was to develop a valid and reliable theory-driven instrument, specific to the military, assessing these determinants resulting in effective interventions. The health belief model was used as the theoretical basis for the instrument.

The procedures employed USAF expert and employee focus groups to establish instrument validity. A two-judge content validity index was calculated using judges from the expert focus group. Reliability was established by test-retest administration of the instrument. An analysis of Cronbach's alpha was used to assess the test-retest reliability of the health belief model constructs.

The focus groups established that the instrument is valid. Reliability of the instrument varied by construct, with the majority of the constructs having sufficient reliability to make the instrument useful for assessing determinants of behavior contributing to the use of PPE. More research is recommended to enhance the reliability of the instrument and to demonstrate equal value in the non-military situation. The developed instrument fills a need for theory-based instruments that can be used to plan theory-driven interventions that target increasing appropriate PPE use.

1315 Nucleic Acid and Protein Detection Technology: Limitations, Milestones, and the Continuous Search for the Holy Grail

United States Air Force School of Aerospace Medicine (USAFSAM)/PHT, Brooks City Base, TX

Clarise R. Starr, PhD

Successful detection of pathogens and toxins in a deployed situation is only as good as the technology that is implemented. The field of nucleic acid and protein detection is evolving, with transformation to smaller instrumentation with greater computing power that can provide more information faster in a single assay. However, by the time one instrument has been evaluated for potential use, it is quite common for another generation of technology to be released. The current topic will focus on trends in this field, and discuss currently fielded instrumentation for nucleic acid and protein detection utilized by the USAF and the DoD. Our evaluations of Film Array and Meso Scale PR2, two new instruments that are thought to be the next generation of nucleic acid and protein detection, respectively, will be presented. In addition, the journey to generating a single platform for both pathogen and toxin detection will be discussed with emphasis on current and future technologies that may eliminate the foreknowledge needed to design target specific assays.

1345 Upper Respiratory Virus Serotype Panel for the Pyrosequencer
Applied Technology Center

James Baldwin, DR02/Molecular Biologist

Pyrosequencing is an excellent way to detect clinical infections. Unlike PCR-only assays, the pyrosequencer can discriminate sequences based on DNA sequence. Sequence evaluation allows precise detection while often providing the serotype of the detected organisms. Under investigation is the use of deeply multiplexed PCR tests followed by a rapid pyrosequencing step to identify detected organisms. The test uses low-specificity primers to amplify related sections of important upper respiratory virus genomes. The exact identity of any given product is then determined by DNA sequencing short sections of the PCR product (up to 50 bp). The sequences are used as tags to accurately identify organisms from a database of possible results extracted from Genbank. Assays were designed for the pyrosequencer to detect and serotype influenza (A, B, C), several human coronaviruses (HKU1, NL63, 229E, OC43, SARS), adenovirus (most serotypes including 3, 4, 7, 11, 14, 21), parainfluenza (1, 2, 3, 4), metapneumovirus, Picornaviridae (most rhinovirus, enterovirus, Coxsackie virus, echovirus, and poliovirus), and respiratory syncytial virus (A, B). The assays were designed to work in a single multiplexed tube and as individual tests. Results indicate that adenovirus, coronavirus, and Picornaviridae assays offer a robust detection and identification method. In some assays (Picornaviridae, for example) we can theoretically detect/serotype over 100 viruses in a single test by sequencing less than 25 bp. This work is designed to support the public health mission of the DOD through enhanced diagnostic testing of clinical samples, including those from the recruit and enlisted populations.

1430 The Use of Retinal Photographs for AFSOC Flyers at Risk for Laser Eye Injuries: Evaluation as Screening Exam
United States Air Force School of Aerospace Medicine (USAFSAM)/FEER

Lt Col/Dr. Christopher Hudson

The increasing availability of lasers has led to a proliferation of laser illuminations of airplane cockpits and crews during flight. Such illuminations not only present flight safety issues such as distraction or visual disturbance, they could in some cases result in damage to the retina. The United States Air Force Special Operations Command (AFSOC) has initiated retinal photographs for its aircrew to be used in the event of a laser eye exposure incident. Since 2004, all flyers were required to have a reference retinal photograph to use as comparison to their exam after a laser exposure. The intent of the retinal photograph is to enhance the ability of the examining provider to detect laser associated retinal damage. The frequency at which such retinal photographs should be repeated as a screening exam has not been determined. The purpose of this study is to examine retinal photographs of AFSOC flyers as a screening exam. As with any screening exam, the factors to consider are the incidence and prevalence of the condition, the sensitivity and specificity of the screening exam, the cost effectiveness of screening, the appropriate screening interval and any unintended consequences related to screening. After considering each of these factors, our recommendation is that baseline retinal photographs for AFSOC flyers are not recommended as an effective as a part of a medical surveillance screening program for potential laser eye injuries. This recommendation is based on the lack of injuries reported in aviators, the limited number of documented ACS injuries over the past 15 years, the cost and lost work time associated with screening and the limited use as a screening tool.

1500 Visual Performance Enhancement with Macular Pigment in Glare Condition
AFRL 711th Human Performance Wing (HPW)/RHDO

Dr. Leon McLin

PURPOSE: Macular pigment's presence in the fovea is thought to enhance visual performance in glare. This study sought to determine if differences in macular pigment optical density (MPOD) are associated with differences in 3 measures of visual performance under conditions of glare: 1) photostress recovery, 2) disability glare, and 3) visual discomfort. METHODS: Spatial profiles of MPOD were assessed for twenty-six subjects with heterochromatic flicker photometry. Glare was delivered dioptically, in free-view, via two bright white LEDs. For the disability glare and photostress recovery conditions, the visual task consisted of determining the contrast threshold for correct identification of a 1degree Gabor patch's orientation. Visual discomfort was assessed with a visual discomfort rating scale. Pupil diameter was monitored with an IR camera. RESULTS: Low MPODs were associated with higher contrast thresholds even for the control condition without glare. Higher MP values resulted in faster photostress recovery times, lower disability glare contrast thresholds, and lower visual discomfort. Subjects' pupil diameter during glare was significantly correlated with higher visual discomfort ratings. CONCLUSIONS: Macular pigment improves three aspects of visual performance in glare. Unlike previous studies, the present study used free-viewing conditions so effects of iris pigmentation and pupil size could be accounted for. Therefore, the effects described can be extended more confidently to "real-world," practical visual performance benefits.

1530 Identification of Serum Biomarkers of Directed Energy Induced Retinal Injury

United States Army Medical Research Institute of Chemical Defense (USAMRICD)

LTC Deborah Whitmer, 62nd MEDBDE Theater Veterinarian

MILITARY SIGNIFICANCE: Today on the battlefield military personnel are exposed to numerous non-kinetic ballistic risks to their vision such as directed energy (laser) sources and non-penetrating blast effects. Detection of subtle non-penetrating blast and directed energy retinal injuries by retinal specific biomarkers is a desirable field diagnostic capability. OBJECTIVE: Determine if specific retinal biomarkers are measurable in serum after discrete DE retinal injuries occur. METHODS: Laser lesions were created in both eyes of anesthetized non-human primates (NHPs) (n=20 animals). An alpha-2-agonist and non-steroidal anti-inflammatory were administered topically concurrently with a unilateral intravitreal injection (saline or steroid) then evaluated for effects on lesion healing. Serum samples were collected from all NHPs pre and post DE exposure then at regular intervals during the treatment phase and at the terminal end point (minimum of 180 days post retinal injury). The levels of cytokines and chemokines were determined in serum using Millipore's MILLIPLEX™ Non-Human Primate Cytokine kit. The assay coupled with the Luminex xMAP® platform, simultaneously quantified 23 human cytokines and chemokines. RESULTS: Six of 23 assayed serum cytokines/chemokines were detectable at all time points from injury to end point in all NHPs tested. CONCLUSIONS: Preliminary results indicate that specific serum cytokine/chemokines biomarker(s) exist for discrete DE induced retinal injury.

Nursing Track

ABSTRACTS

Tuesday, 24 August 2010

1300 Secondary Insults of Traumatic Brain Injury in CCATT Patients Returning from Iraq/Afghanistan

United States Air Force (USAF), University of Maryland; Baltimore, MD

Maj Susan Dukes

BACKGROUND: Traumatic brain injury (TBI) patients are highly susceptible to secondary insults to the injured brain (e.g., hypoxia, hypotension, hyperthermia, hypothermia, and hyperglycemia). Over one third of the patients transported by Critical Care Air Transport Teams (CCATT) have had TBIs. Considering CCATT patients travel thousands of miles, pass through multiple hospital systems, and are exposed to the stresses of flight on military cargo aircraft, the occurrence and timing of these secondary insults need to be explored. PURPOSE: This study describes the occurrence of secondary insults in isolated TBI patients transported by CCATTs from the point of injury to arrival in the United States between 2001 and 2006. METHODS: A descriptive retrospective cohort design was used to conduct a secondary analysis of 64 CCATT patients with isolated TBI from the Wartime Critical Care Air Transport Database. Data elements in the database were abstracted from existing records including theater trauma registry, transport documents, flow sheets, and hospital medical records. RESULTS: Over half (52%) of the study patients developed at least one secondary insult before returning to the US. Hyperthermia (47%) followed by hypoxia (27%) occurred at the greatest rates. The greatest occurrence of hyperthermia was reported during the patients' stay at Landstuhl Regional Medical Center (LRMC)(40%) and the CCATT transport from LRMC to the US (41%). The greatest occurrence of hypoxia was reported while the patients were still in theater (30%). Data analysis is ongoing.

1330 Iron Status of Deployed Military Members

59th CSPG/SGVUS

Maj Candy Wilson

The purpose of this study is to determine the iron status of deployed military personnel, specifically the prevalence of iron deficiency (ID)/iron deficiency anemia (IDA) while stationed at moderate altitude. Iron is a prerequisite for the production of new red blood cells. In the event of reduced availability or iron, one can develop ID and IDA. ID/IDA causes a reduced oxygen carrying capacity. The prevalence of women and men with ID in military training environments is between 11-44% and 3-33%, respectively. ID/IDA has been known to impair physical and cognitive functioning. The research questions are:

What is the iron status of a deployed sample at moderate altitude?

Is there a difference in the prevalence of ID/IDA between deployed men and women?

Is there an increased incidence of ID/IDA in deployed women who have menstruation as compared to deployed women who do not have menstruation?

This study is a descriptive co relational research design. The researchers will examine the relationships between home station altitude, history of anemia, recent blood donation, vegetarian diet choice, and multivitamin us to blood results. For women, researchers will determine if a correlation between menstrual history and iron status exists. Blood analysis will include hematocrit, hemoglobin, mean corpuscle volume, iron, total iron binding capacity, Ferritin, and soluble transferring receptor. The sample will consist of service members deployed greater than three months at Bagram Airfield Afghanistan. The projected sample size is 400 (200 mean, 200 women). ID/IDA is a significant impediment to a fit, healthy, and functioning military force. The identification of risk factors contributing to ID/IDA among active duty U.S. forces in a deployed environment will lead to interventions that improve the combat power and effectiveness of the U.S. military. This study will be completed 30 May 2010.

1400 Air Force Nurse Transition Program

88th MDG

Col Robie Hughes

BACKGROUND: The Air Force Nurse Transition program was established in 1977 for Air Force nurse accessions with less than one year of clinical experience as a registered nurse. Today the program is held at 8 military and 2 civilian training sites. The course length varies according to location. At military training sites the course length is 11 weeks long. At the civilian locations (Cincinnati and Scottsdale) the course has been reduced to 9 weeks because students completed clinical skills requirements quicker due improved access to patients. No research studies on the measurement of nursing performance related to the Air Force Nurse Transition program has been published. SPECIFIC AIMS: 1) Implement valid and reliable instruments to

measure nurse transition student performance during medical simulation scenarios. (2) Establish base line data on new nurse accessions' performance upon entrance to the military and prior to attending the Air Force Nurse Transition Program based on the simulation scenario evaluation instruments.(3) Determine the impact of the Air Force Nurse Transition Program on graduates' performance during medical simulation scenarios based on the Simulation Evaluation Instrument. (4) Compare military nurses enrolled in the Air Force Nurse Transition Program at civilian training sites to those at the military training sites in terms of pre and post attendance subscale scores on the simulation scenario evaluation instruments. METHOD: Samples (multisite) Repeated Measurement Pre-test/Posttest Comparative design. Each group at one of 10 sites is evaluated using a simulated medical scenario prior to attending and upon completion of the Air Force Nurse Transition Program. No control group will be used for this study because it is not feasible to have a "no training" group, nor to have subjects act as their own control for the same length of time (9 to 11 weeks) as in the training program. Findings: To be determined. At the time of the AFMS Symposium, 8 classes of NTP students (28 total classes projected for FY 10) will have gone through the study pre and post NTP. Data collected from the 8 classes will be presented as findings during the presentation. DISCUSSION: Information will be discussed regarding the partial findings from this study. The data collection will continue through 17 Dec 10.

1445 Inpatient Glycemic Management Team at Wilford Hall Medical Center
Wilford Hall Medical Center (WHMC)

Stacey Ward, MSN, RN, CNS-BC, BC-ADM, Lexa Rijos, MSN, RN, ACNP-BC, Linh Reeves, MPAS, PA-C, Joe Pollard, MPH, Mark W. True, MD, and Brian T. Allenbrand, MD

Best practices direct hyperglycemic management in the acute care setting to be at the forefront of providing quality care for either hospitalized diabetic or non-diabetic patients. As demonstrated by current research, sustained hyperglycemia results in increased hospital length of stays and infection rates. As part of the American Diabetes Association and The Joint Commission inpatient diabetes recognition program, an attribute for success is having an identified program champion team. In August, 2009 Wilford Hall Medical Center, an Air Force medical center in San Antonio, TX, formed an inpatient glycemic management team (IGMT) comprised of mid-level providers to include a nurse practitioner (NP), physician assistant (PA), and clinical nurse specialist (CNS). One role of the team is to consult and provide recommendations for glycemic management strategies in the critically and non-critically ill patients while monitoring blood glucose rates for hypoglycemia (< 70 mg/dl). From September 2009 to February 2010, the rate of acceptance of recommendations provided was 90.2%. Comparing September 2008- February 2009 to September 2009 - February 2010 for overall hypoglycemia in the non-critically ill was 2.4% and 1.7%, and hyperglycemia (> 180 mg/dl) was 31% and 30%, respectively while the critically ill population had an overall rate of hypoglycemia of 1.7% and 1.5%, respectively. As evidenced by an overall acceptance of recommendations demonstrating a decline in hypoglycemia and hyperglycemia rates, using an IGMT to direct inpatient hyperglycemic care is an effective methodology of providing best practices for this patient population.

1515 Diabetes Self-Management Education at a Military Hospital
University of Pittsburgh Medical Center (UPMC)

Ellen Kilpatrick, RN, CDE, Nina Watson, RN, CDE, Joseph Pollard, MPH; Acknowledgements: Linda Siminerio*, RN, PhD, Kristine Ruppert*, DrPH

BACKGROUND: Diabetes self-management education (DSME) is considered to be an important part of management and has been directly associated with a decrease in HbA1c levels. Patients who do not receive DSME are found to be four times more likely to develop a major complication and incur higher diabetes-related hospital costs. Self-management is considered to be a key component of the Chronic Care Model (CCM). As part of our effort to deploy the CCM in a military environment, we established a Diabetes Center of Excellence (DCE) at Wilford Hall Medical Center (WHMC) for high risk diabetes patients. The DCE included an ADA recognized program. Our objective was to determine the impact of DCE patients who received DSME on HbA1c levels. METHODS: Patient military beneficiaries who received DSME between January and December 2009 with at least 1 recorded baseline and follow-up HbA1c were included in the analysis. RESULTS: A total of 207 patients (mean age 58 years, 51% male, 43% Caucasian, 29% Hispanic, and 22% African American) participated. Prior to program 39.6%; post program 17.4% had HbA1C >8%, representing an overall 1.1% HbA1c reduction. 69.6% of patients showed improvements. After adjusting for pre HbA1c and race, completing the DSME classes showed a significant decrease (p=0.001). CONCLUSIONS: These findings demonstrate the added benefit of integrating a formal DSME program in diabetes specialty clinics for military beneficiaries. DSME can be considered an important adjunct in diabetes specialty care.

Closing Plenary Session

Presentation slides are in appendices as noted.

Blood Pharming (See Appendix G)	**Dr. Stewart Abbot Celgene Cellular Therapeutics**
Mild Traumatic Brain Injury and Sleep (See Appendix H)	**Dr. Michael Russo Traumatic Brain Injury Neurologist**
Defense Centers of Excellence (DCoE) (See Appendix I)	**Dr. George Johnson TBI Directorate**
DoD "Use of Laboratory Animals" Updates	**COL Annette Hildabrand Deputy Director, Animal Use Programs**
Simulation Training Research- Trauma Man (See Appendix J)	**Capt Andrew Hall 81 MDG**
Joint Technical Coordinating Group (JTCG) Updates (See Appendix K)	**Col Ray Santullo Air Force Liaison to JTCG**
Leadership Brief	**Lt Gen Bruce Green Air Force Surgeon General**

Poster Abstracts

Poster Abstracts

ABSTRACTS

1. Genetic Factors Influencing Rate of Moderate Altitude Acclimatization and De-acclimatization
United States Air Force Academy (USAFA)

Chloe J. Angello, Jeffery L. Nelson, Michael F. Zupan, Rebecca M. Gulledge, Camilla A. Mauzy, Brandon K. Doan, and Michael D. Brothers

INTRODUCTION: Previous U.S. Air Force Academy (USAFA, 2210m) research has demonstrated significant physiological adaptations to moderate altitude (MA; > 1500m). These studies have also revealed tremendous individual variability in acclimatization and de-acclimatization rate, which may be influenced by genetic factors. PURPOSE: To investigate the rate of adaptation and de-adaptation to long-term MA exposure and possible underlying genetic factors by analyzing hematological and genetic data among USAFA cadets. METHODS: Total hemoglobin mass (THM) was repeatedly assessed among sixty freshmen (42 males, 18 females) age 18.3 + 0.4 years who were categorized based on hematological adaptation rate. Various genetic factors associated with altitude were assessed and significant ($p < 0.05$) differences and correlations examined. These genetic factors included: angiotensin-converting enzyme (ACE) I/D; endothelial nitric oxide synthase (eNOS) 4b/a and Glu298Asp; endothelin-1 (ET-1) Lys198Asp; hypoxia-inducible factor-1 (HIF-1) Ala588Thr and variable number tandem repeats (VNTR); heat shock protein 1B (HSPA1B) A/G; vascular endothelial growth factor (VEGF) G/T; VEGF receptor 1 precursor (VEGFR) C/T; and heme oxygenase-1 (HO-1) VNTR. RESULTS: Significant ($p < 0.01$, $r > -0.432$) correlations were evident between the rates of MA acclimatization, de-acclimatization, and re-acclimatization among former SL subjects. Additionally, the acclimatization rate was significantly ($p < 0.05$, $r > 0.23$) correlated with the tested genetic variants. These associations included the eNOS and ET-1 mutations, both genetic variants commonly found in Sherpa populations naturally adapted to high altitude. CONCLUSION: Our results indicate that some of the variability in MA acclimatization may be explained by individual genetic differences. Future research is warranted.

2. A pilot's ability to properly identify and react to flying emergencies will improved with a five-week sports vision training program
87th AMDS/SGPE

Maj Richard Baird

The purpose of this study is to assess whether a pilot's ability to properly identify and react to flying emergencies will improved with a five-week sports vision training program.

Professional, Olympic, and college athletes use sports vision training in order to improve their performance. The tachistoscope and the Sports Vision Trainer (SVT) have been designed to significantly increase the ability to more quickly and accurately perceive and react to stressful events in three ways: 1) Expanding peripheral/situational awareness, 2) Accelerating reaction/response speed and 3) Providing pinpoint eye-hand coordination. Anecdotal reports showcase dramatic results, but minimal research has been undertaken to verify the nature of the improvement.

The preparation for and stresses of war have been compared with those of athletic competition. Research has shown that, pilot visual abilities and demands, like those of athletes, are superior to those of the average individual. Flying a plane--especially during wartime--brings its own set of stresses and visual stimuli necessitating proper awareness/judgment and accurate motor output.

Volunteer air-crew members from Jt Base McGuire-Dix-Lakehurst are participating in the study. Each receives initial SVT, tachistoscope and C-17/KC-10 simulator check-ride testing along with a questionnaire. Subjects will practice on the SVT or tachistoscope for 30 minutes, three times a week for five weeks. Controls will spend similar time reading technical instructions on how to identify and react to emergencies. After the training period, all participants receive the same testing sequence as a post-test. Improvements in check-ride performance will determine the validity of the training.

3. Advanced and novel neurological measurements in a model of critically ill cyanide toxicity

59th MDW Wilford Hall Medical Center (WHMC)

Dr. Vik Bebarta

BACKGROUND: Cyanide is a commonly used terrorism weapon and is product of combustion in structural and vehicle fires in garrison. Previous rudimentary measurements have focused on a lactic acidosis. We have recently described hypotension and cardiovascular hemodynamics resulting from cyanide toxicity. OBJECTIVE: To evaluate the electrocardiographic (ECG) measurements, invasive brain tissue microdialysis metabolites, and noninvasive brain near infrared spectrometry (NIRS) as novel or bedside measurements of cyanide toxicity. METHODS: 24 swine were intubated and instrumented. A continuous cyanide infusion was started, until the development of severe hypotension (50% of baseline MAP). Animals were randomly assigned to intravenous or intraosseous hydroxocobalamin and monitored for 60 minutes after the start of antidotal infusion. Group size analysis based on a power of 80% yielded a sample size of 12 animals per group for comparison. RESULTS: We have interim analysis data. 1 animal in each arm died thus far. ECG findings were significant and showed ST depression and interval width changes. NIRS shows a significant declined during cyanide infusion and rise with antidote administration. Microdialysis collection is still in preparation. Samples has been collected but not completed. Preliminary animals showed a rise in brain acidosis. The animals developed hypotension, lactate acidosis, and recovery similarly to our previous models. CONCLUSION: We are evaluating novel and noninvasive measurements of cyanide toxicity. These measurements may be able to detect cyanide toxicity at the bedside rather than cyanide levels which cannot be routinely. In addition, these measurements may be able to prognosticate cyanide toxicity better than current methods.

4. Advanced Magnetic Resonance Evaluation of Traumatic Brain Injury and Post-Traumatuc Stress Disorder

59th Radiology SQ, Lackland AFB

Maj Nathan Cecava

Traumatic brain injury (TBI) and post-traumatic stress disorder (PTSD) have increasingly impacted the health and wellbeing of many of our military members and veterans. Diagnosis and quantification of disease has largely relied upon extensive clinical evaluation of diseased and non-diseased individuals. In many cases, diagnosis is delayed secondary to late symptom onset. These disease entities are rarely evident on conventional brain imaging, however, advances in magnetic resonance (MR) imaging, including functional MR, diffusion tensor imaging, and volumetric imaging in addition to conventional gradient echo imaging yield exciting new possibilities in objective assessment to aid diagnosis and treatment.

The objective of this presentation is to demonstrate the advanced imaging techniques used in the San Antonio Military Medical Center (SAMMC) evaluation of TBI and PTSD in the acute and chronic clinical settings. Diffusion tensor imaging is utilized to pinpoint diffuse axonal injury in mild to moderate traumatic brain injury, occult in conventional imaging. Functional MR provides non-invasive identification of specific brain foci of disease in PTSD during clinical testing. Volumetric imaging of select brain anatomy is utilized to assess TBI/PTSD severity and treatment response.

These imaging modalities are in their infancy, but offer great hope in early diagnosis to prevent compounding injuries, and provide objective assessment of disease progression and treatment success. SAMMC Neuroradiology has found these advanced MR techniques to be increasingly beneficial in supporting the military patient population and aiding our referring clinicians.

5. Psychological Attributes That Lead to RPA Sensor Operator Success

United States Air Force School of Aerospace Medicine (USAFSAM)

Wayne Chappelle

INTRODUCTION: USAF Remotely Piloted Aircraft (RPA) MQ-1 Predator and MQ-9 Reaper Sensor Operators (SOs) have a pivotal role in reconnaissance, surveillance, & precision strike aerial operations. They are central to safe and efficient identification, targeting, and battle damage assessment of enemy combatants and assets. Although comprehensive job analyses have been conducted and human performance models of RPA SOs proposed, there is currently no operationally defined list of psychological attributes critical to the performance of RPA SOs to guide aeromedical assessment & selection procedures. METHODS: To fill the current gap, the authors of this study conducted several standardized individual and group interviews with MQ-1 and MQ-9 subject matter experts (N=68; line commanders, pilots, sensor operators, and instructors) from ACC and AFSOC operational squadrons to: (a) review the duties of SOs, and (b) identify the psychological attributes considered critical to distinguishing successful RPA SOs from training failures and those with chronic performance problems. RESULTS: The results of the study are organized into an aeromedical list of operationally defined psychological attributes deemed critical to training and operational performance (i.e., cognitive proficiency, visual spatial processing, memory, vigilance, dexterity, reasoning, stamina, resilience, confidence, assertiveness, cohesiveness, flexibility, conscientiousness, adaptability, and motivation). DISCUSSION: The list of attributes deemed critical to performance by SMEs enhances communication between RPA operators, line commanders, and aeromedical providers regarding unique psychological demands of RPA SO duties. Such attributes can be measured and quantified using objective standardized instruments (e.g., intelligence testing) and compared with performance evaluations to improve aeromedical assessment & selection procedures.

6. Psychological Attributes That Lead to RPA Pilot Success

United States Air Force School of Aerospace Medicine (USAFSAM)

Wayne Chappelle

INTRODUCTION: USAF Remotely Piloted Aircraft (RPA) MQ-1 Predator and MQ-9 Reaper pilots have a pivotal role in reconnaissance, surveillance, and precision strike aerial operations. The demand for such pilots in current theaters of conflict is rapidly increasing. As a result, a high level of medical attrition among incumbents and trainees is unacceptable. Although comprehensive job analyses have been conducted and taxonomy of knowledge skills and abilities proposed, there is no clear operationally defined list of psychological attributes critical to the performance of RPA pilots to guide aeromedical assessment and selection procedures. METHODS: To fill the current gap, the authors of this study conducted several standardized individual and group interviews with MQ-1 and MQ-9 subject matter experts (N=87; line commanders, pilots, and instructors) from ACC and AFSOC operational squadrons to: (a) review the duties of RPA pilots, and (b) identify the psychological attributes considered critical to distinguishing successful RPA pilots from incumbents and trainees with performance and adaptation problems. RESULTS: The result of this study is an aeromedical list of operationally defined attributes organized into cognitive (e.g., cognitive proficiency, visual spatial abilities, memory, vigilance, reasoning), personality (e.g., composure, perseverance, adaptability, conscientiousness), and motivational (moral and occupational) attributes deemed critical to RPA pilot performance. DISCUSSION: The list of attributes deemed critical to performance by SMEs enhances communication between RPA operators, line commanders, and aeromedical providers regarding the unique demands of RPA pilot duties and operations. Such attributes can be measured and quantified using objective standardized instruments (e.g., intelligence testing) and compared with performance evaluations to improve assessment & selection procedures, as well as aeromedical evaluations. This study also provides recommendations for

aeromedical assessment and selection procedures.

7. Using Radio Frequency Identification (RFID) to improve your clinical process and patient safety

Shipcom Healthcare

Scott Cobb

Shipcom Healthcare has implemented an enterprise RFID system and other Automatic Indentification Data Collection (AIDC) technologies at Keesler AFB during a 2 year Research Development Test & Evaluation (RDT&E) project for the AFSG office. Primary goals and objectives were to investigate how RFID could improve clinical and business processes within a Military Treatment Facility (MTF), create business cases with benefits and Return on Investment (ROI) for four applications, and validate with Proofs of Concept (POC). The selected applications: Medical Equipment Asset Tracking, Patient flow, Medication Administration Assistance, and Surgical Tray/Instrumentation Tracking.

Asset Tracking application tagged over 1600 assets, enterprise coverage over 550,000 square feet with in room level accuracy. Preventive maintenance improved over 33% for on time performance with reduction/elimination of Unable to Locate (UL) and Report of Survey (ROS). Average search time for tagged equipment was measured at an average of 2 minutes 21 seconds.

Surgical Instrument and Tray tracking was executed using a 2 dimensional bar code that was etched on over 6500 instruments. Tray count sheets were automated which allows scanning of each instrument during tray preparation providing 100% accuracy. Current tray tracking is with the use of bar codes, with the next phase will include the utilization of Autoclavable RFID tags.

Implementation Guidelines for these two applications will be addressed in addition to the research findings for Patient Flow and Medication Administration Assistance. Shipcom has received Authority to Operate (ATO) from Air Force Medical Service Agency for the Asset Tracking Solution. In-flight hypoxia events in tactical jet aviation: Characteristics and Symptoms

8. In-flight hypoxia events in tactical jet aviation: Characteristics and Symptoms

Uniformed Services University of the Health Sciences

LCDR Eric Deussing; Other Authors: A. R. Artino and R. V. Folga

INTRODUCTION: Hypoxia continues to be a significant threat in military aviation. To counter the hypoxia threat, military aviators receive periodic training using a low pressure chamber (LPC) or a reduced oxygen breathing device (ROBD). Results from previous research indicated the hypoxia symptoms reported by aviators trained on the LPC or ROBD are similar but not identical. These findings raised concern that the hypoxia symptoms experienced during training (LPC or ROBD) might also differ from those encountered during actual in-flight hypoxia events. This study explored the characteristics of in-flight hypoxia events among tactical jet aviators and compared the reported symptoms to those experienced by aviators during normobaric (ROBD) hypoxia training. METHOD: An anonymous survey was administered to U.S. Navy aviators prior to aviation physiology training. The survey queried participants about their previous encounters with in-flight hypoxia and the symptoms they experienced. RESULTS: Of the 566 aviators who completed the survey, 112 (20%) reported experiencing hypoxia symptoms in a tactical jet aircraft. Among these reports, 45 (40%) occurred in the F/A-18, 38 (34%) occurred in the EA-6B, and the remaining 29 (26%) occurred in other platforms. Altogether, the reported hypoxia incidents occurred at an average altitude of 25,064 ft mean sea level (SD = 8,433 ft), and 64 aviators (57%) indicated that they were not wearing the required oxygen mask when the incident first occurred. The three most commonly reported in-flight hypoxia symptoms were tingling (54%), difficulty concentrating (32%), and dizziness (30%). Chi-square analyses revealed differences between the symptoms encountered during actual in-flight mask-on events and those experienced during ROBD training. DISCUSSION: These results provide insight into the characteristics of

actual in-flight hypoxia events and suggest that in-flight hypoxia symptoms may differ from those experienced during hypoxia training.

9. Environmental Enrichment as a Neuro-protective Strategy
711 HPW/RHPA

Erica J. Doczy, Stuart W. Hoffman, James P. Herman, Catherine R. Harrison

Traumatic Brain Injury (TBI) is a major concern for the general and military population causing occupational disabilities and deficits in the areas of memory, social and executive function. This study evaluated a non-invasive, non-pharmaceutical technique of protection against these deficits through environmental enrichment (EE). EE increases cortical weight, neuronal density, dendritic branching, and angiogenesis. In a rodent model, EE is used successfully as a therapy following traumatic brain injury to reduce functional deficits in motor function, spatial memory, and learning. To examine the neuroprotective benefit of EE, adult male rats were placed in an enriched environment for 15 days. Enrichment was provided through social interaction, exercise, olfactory stimulation and new objects/toys to explore. Following enrichment (4 months of age), experimental and age-matched controls received a moderate medial prefrontal cortex injury via controlled cortical impact. After one week recovery, animals were behaviorally tested to assess memory, anxiety, and sensory neglect. Lesion-induced deficits in spatial memory (Morris water maze) were significantly attenuated in EE rats. In addition, sensory neglect was reduced in EE rats relative to non-enriched animals. No differences in anxiety-like behavior on the elevated plus maze were detected. These data suggest that the environmental enrichment is neuroprotective, resulting in improved recovery following injury. This data may ultimately be used to enhance an individual's resiliency to TBI.

10. Investigating the Association of White Male Lung Cancer Mortality and State of Residence
82 AMDS/Sheppard

Maj Thomas Doker

Lung cancer is the most common cause of cancer-related death. Most lung cancer is the result of a preventable cause, smoking. Nevertheless, U.S. tobacco production remains the fourth highest globally. This study examined U.S. white male lung cancer mortality by State of residence and the associated risk factors of tobacco acreage, rural residence, smoking, poverty, lack of health insurance, and radon exposure. White male lung cancer mortality was significantly correlated with tobacco acreage ($r = .455$), rural residence ($r = .389$), and smoking ($r = .475$). Tobacco acreage ($P = .005$), rural residence ($P = .011$), and smoking ($P = .030$) remained significant with regression analysis. Tobacco-growing states (20 years prior), rural states, and states with higher adult smoking prevalence (13 years prior) were shown to have statistically higher lung cancer mortality among white males. The causes for this mostly preventable cause of death need further investigation in order to target effective public health interventions.

11. Utilizing the JBAIDS to Provide Synergistic Potential for the Identification of Food Borne Illnesses
USAFSAM/PHT1 and USAFSAM/PHD2; Brooks City-Base, TX

Elizabeth M. Escamilla1, MS, Mark W. Lehman, Maj, USAF, BSC, DVM, MS, MPH2, Linda S. Armstrong1, MS, Robert A. Alcorta, BS1, Clarise R. Starr, PhD1 and David L. Maserang, PhD1

INTRODUCTION: The High Molecular Load Kit (HMLK) offers a simple culture procedure to detect aerobic microorganisms in food within 24-48 hours with minimal investment in training and equipment. The HMLK is designed to detect the presence of most naturally occurring bacterial contaminant at high levels indicative of spoilage or intentional bacterial contamination that could result in potential acute disease. The purpose of this initiative was to combine the capabilities of the HMLK with the speed and specificity of real-time polymerase chain reaction (PCR) detection by utilizing the already fielded Joint Biological Agent Identification and

Diagnostic System (JBAIDS) instrument to test food for the presence of these contaminants. METHODS: Meals Ready-to-Eat, Individual (MREs) were spiked at high and low concentrations with four enteropathogens, Escherichia coli 0157:H7 (EHEC), Shigella, Salmonella, and Campylobacter, and evaluated using both the HMLK and the JBAIDS species-specific assays. RESULTS: EHEC was detected at high and low concentrations by both HMLK and JBAIDS assays. At low concentrations (~1-2 cfu/g), Shigella and Salmonella were not detected by HMLK but detected by JBAIDS. Campylobacter was not detected at high or low concentrations by the HMLK but was successfully detected by the JBAIDS assay. CONCLUSIONS: A synergistic relationship between JBAIDS and HMLK was seen and illustrated the advantage of running two different diagnostic techniques to increase the opportunity of detection. This strategy increases mission capabilities for both procedures, expanding the JBAIDS from a bioweapon response to a tool to investigate non-intentional bacterial food contamination events.

12. Gene modulation in human keratinocytes after exposure to different sizes of gold nanoparticles

711 Human Performance Wing (HPW)/RHPA

Garrett CM, Schrand AM, McDougal JN, and Hussain SM

The unique properties of gold nanoparticles (Au NPs) due to their small size, plasmonic nature, relative biocompatibility, and wide array of biological applications have revolutionized the field of nanobiotechnology. However, understanding the potential molecular effects after low dose nanoparticle exposure remains poorly understood. In order to assess the bio-effects of sub-toxic concentrations of gold nanoparticles (Au-NP) on human keratinocytes, whole-genome expression analysis was performed. Ingenuity Pathway Analysis determined 368 differentially expressed genes in Au NP treated cells that were members of intracellular networks corresponding to Canonical pathways of cell-mediated immune response, cellular development, organization, and maintenance, and stress response. Moreover, there are size-dependent differences in the gene expression profiles of these materials. The smallest particles tested (10nm) induced primarily up-regulation of genes involved in stress and inflammatory responses (S100A9, CD44, EPPK1), and signal transduction (RASAL2). In contrast, the largest particles tested (60nm) resulted mainly in the down regulation of genes involved in maintaining cell stability (DCN, SCAMP1), cell signaling (EPHA4) and cell trafficking (SCAMP1). The intracellular uptake of all of the different sized Au NPs was demonstrated via TEM and ultrahigh resolution light microscopy. In summary, the results demonstrate that size dependant uptake of Au NPs altered some of the key genes involved in inflammation, stress response and cellular development. Further work is needed to discern implications of gene alterations on protein expression in order to conclude functional effects of gold.

13. Screen-to-Detect Capability: Prototype Development

United States Air Force Academy (USAFA), Department of Biology

Harrison Gebs, Melanie Grogger, and Carlos J. Maldonado

INTRODUCTION: Currently, several Air Force MAJCOMs have a requirement for a screen-to-detect capability requirement against infectious disease agents and other pathogens of operational significance. The ideal platform will be a handheld/portable system, which can reliably screen samples for the presence of pathogens or other biological agents. This capability will afford a rapid ($\leq$ 30 min) sample to answer turnaround time, from a variety of clinical and environmental matrices (sample types). The intended use of this platform is the efficient/reliable screening of both troops and equipment returning from deployed locations as well as those reporting to base from a routine operational tour in foreign countries. METHODS: In collaboration with Oak Ridge National Laboratory (ORNL) in Tennessee, the US Air Force Academy is using real time PCR system techniques as a standard in developing a working prototype capable of screening multiple

clinical samples for the presence of upper respiratory disease including but not limited to the H1N1 virus. The recent (July 2009) H1N1 outbreak at the academy showed that patients were 'shedding' infectious particles 24 hours before they presented febrile respiratory illness symptoms. Several preliminary trials were run for sample preparation and sensitivity/selectivity against pathogens of operational significance. SUMMARY: Once fielded, our biosensor platform will be able to minimize the negative operational impact infectious disease outbreak by successfully screening and identifying early potentially contagious (carriers) personnel before they present symptoms and infect other members in their unit.

14. Heat and Moisture Exchanger (HME) Performance in the AE Environment
United States Air Force School of Aerospace Medicine (USAFSAM)/ FEEH

John Kalns

PURPOSE: Heat and moisture exchangers (HME) are used for airway humidification in mechanically ventilated (MV) patients. Thus far, HMEs have only been evaluated under hospital conditions, although they are used during aeromedical evacuations (AE) to provide airway humidification for transported MV patients. Military AE are performed under extremely rugged conditions further complicated by the cold (~15ºC) and dry (~30% relative humidity) environment in military aircrafts, which may reduce the effectiveness of HMEs. This study evaluated 10 commercially available HMEs using a model test system that simulated AE conditions. METHODS: The fabricated HME testing system included a simulated patient model (warm chamber), a simulated aircraft model (cold chamber), ventilator, and a data acquisition system connected to a laptop computer. An HME testing region consisting of various connectors allowed for easy replacement of HMEs. Two sets of sensors flanked the HME testing position and continuously measured temperature and % relative humidity on the patient and ventilator sides of the HME. Absolute humidity (AH) outputs for the HMEs calculated using the measured temperatures and % relative humidity were compared. RESULTS: There were some notable differences in the performance of various HMEs both with regard to temperature and humidity on the patient side of the circuit. None of the HMEs tested were able to achieve American National Standards Institute (ANSI) recommended levels of AH value of ≥30 mg/L for MV patients but instead provided levels of ~20 mg/L. CONCLUSION: Passive HMEs may not provide adequate humidification of patient airway during AE missions.

15. HBO Effects on Disease Caused By Deployment Relevant Micro-organism
United States Air Force School of Aerospace Medicine (USAFSAM)/ FEEH

John Kalns

INTRODUCTION: A major concern for wounded soldiers is the threat of infection of the bone, or osteomyelitis. Ballistic projectiles cause trauma which may introduce bacteria into bones and surrounding tissue. Additionally, surgical procedures and orthopedic implants required to mend injured bones may increase exposure to bacterial pathogens. Osteomyelitis is difficult to treat with antibiotics alone and results in significant morbidity, complications, and increased hospitalization time. We hypothesized that a mouse model for implant-associated osteomyelitis can be used to evaluate the efficacy of hyperbaric oxygen therapy (HBOT) in the prevention and/or resolution of infections with deployment-related bacteria, including methicilin-resistant Staphylococcus aureus (MRSA), Pseudomonas aeruginosa, and Klebsiella pneumoniae. MATERIALS AND METHODS: MRSA, P. aeruginosa, and K. pneumoniae were isolated from wounded soldiers. Clinical isolates were grown in liquid cultures overnight and then used to coat stainless steel pins that were inserted into the tibias of C57BL/6 mice to produce chronic osteomyelitis infections. Mice received HBOT (100% oxygen at 2.4 ATA for 80 minutes) prophylactically for 5 days prior to infection followed by 12 or 19 days of HBOT; or mice received HBOT starting 5 days post-infection for 7 or 14 days. Bone lesion severity and bacterial burdens were compared between groups that received HBOT and controls groups that did not receive HBOT.

RESULTS: The rates of infection for MRSA, P. aeruginosa, and K. pneumoniae were 80%, 63%, and 34% and the median bacterial burdens were 9.2x106, 5.7x105, and 6.0x105 colony forming units/gram of tibia, respectively. Lesion morphology differed between the bacteria: MRSA induced abscesses and severe lesions, P. aeruginosa induced moderate to severe lesions, and K. pneumoniae induced mild to moderate lesions.

SUMMARY: This model can be used to evaluate the efficacy of HBOT in a mouse model of implant-associated osteomyelitis with clinical isolates of MRSA, P. aeruginosa, and K. pneumoniae.

16. Analyzing the role of the major outer surface antigens in *Burkholderia* infection
Armed Forces Institute of Pathology

Hyung-Yong Kim

Burkholderia pseudomallei (BP) and B. mallei (BM) are closely related gram-negative, facultative anaerobic bacteria which cause life-threatening melioidosis in human and glanders in horse, respectively. In this study, 3 mouse monoclonal antibodies (BP7 10B11, BP7 2C6, and BP1 7F7) were developed into chimeric MAbs (cMAbs) against BP and/or BM. For the fast-performance production, we constructed 4 major different vector systems with a dihydrofolate reductase (DHFR) amplification marker, and optimized transfection/selection conditions in mammalian host cells with the single-gene and/or double-gene vector system. These 3 cMAbs stably produced by the DHFR double mutant Chinese hamster ovarian (CHO)-DG44 cells were affinity-purified. By ELISA and Western blot analysis using whole bacterial antigens treated by heat (65°C/90 min), sodium periodate, and proteinase K, the cMAb BP7 10B11 (CK1) reacted with glycoproteins (34, 38, 48 kDa in BP; 28, 38, 48 kDa in BM). The cMAb BP7 2C6 (CK2) recognized surface-capsule antigens with molecular sizes of 38 to 52 kDa, and 200 kDa in BM. CK2 was weakly reactive to 14~28, 200 kDa antigens in BP. The cMAb BP1 7F7 (CK3) reacted with lipopolysaccharides (38~52 kDa in BP; 38~60 kDa in B. thailandensis). Western blot results with the outer membrane proteins of the 3 *Burkholderia* species were consistent with results with the whole *Burkholderia* cell antigens, suggesting that these immunodominant antigens reacting with the 3 cMAbs were primarily present on the membrane of the *Burkholderia* species. These 3 cMAbs would be useful for analyzing the role of the major outer surface antigens in *Burkholderia* infection.

17. Medical Flight Screening-Neuropsychiatry Occupational Norms
United States Air Force School of Aerospace Medicine (USAFSAM)

LtCol Raymond E. King

Psychologists and other practitioners who assess individuals who have been thoroughly screened for entry into a competitive career field face a challenge. While their clinical training would led them to use normative values that are published in professional manuals, the individuals they are endeavoring to assess represent individuals at an extreme value in the normal distribution curve. For example, while intelligence tests are normal to have a mean of 100 and a standard deviation of 15, the average US Air Force (USAF) pilot has an I.Q. of 121. Moreover, the standard deviation for this group is 5.5, meaning that an USAF pilot with a measured IQ of 100 is clearly at the extreme left side of the occupational distribution. Therefore, in the absence of the ability to compare a pilot to his or her baseline functioning, it would be best to use occupationally derived norms and not those that are base on a cross section of the US population. Using data collected since 1993, psychologists at the USAF School of Aerospace Medicine are compiling a catalog of norms on clinical instruments, to include the Multidimensional Aptitude battery (MAB), the Personality Assessment Inventory (PAI), and the NEO Personality Inventory-Revised (NEO PI-R). Such a resource will enable base-level clinicians, to include both clinical psychologists and flight surgeons, to compared referred aviators to a relevant pool of occupationally similar individuals. Such a resource will more clearly define who is safe to return to flying duties and who requires additional assessment.

18. Diffusion Tensor Imaging In the Evaluation of Mild Military Blast Traumatic Brain Injury

59th Medical Wing (MDW)

Maj Jeffrey Lewis

Mild traumatic brain injury (mTBI) resulting from blast (e.g., improvised explosive device) exposure is poorly characterized. Twelve right handed active duty males with a history of mTBI and 12 age-matched healthy control participants (5 female) underwent diffusion tensor imaging (DTI) on a Siemens 3T MRI scanner. Voxelwise statistical analyses of white matter (WM) fractional anisotropy (FA) images were conducted to compare groups and perform within-mTBI group regression of Trails B performance, persistent errors on the Wisconsin Card Sorting Test (PE-WCST), and time since injury. Examining the confluence of results (nonparametric p-value = 0.01; > 20 voxel spatial extent) across analyses, the right forceps of the corpus callosum of mTBI patients had significantly reduced WM FA values that were negatively associated with PE-WCST (i.e., lower FA associated with worse performance). Likewise, the left superior longitudinal fasciculus of mTBI participants had reduced WM FA values that were negatively associated with time since injury (e.g., lower FA values with longer time post-injury). These exploratory analyses suggest that DTI is sensitive to alteration in white matter microstructure after blast mTBI and changes may relate to degree of cognitive dysfunction after injury.

19. Use of Staple-Line Bio-reinforcement in a Pig Model (*Sus scrofa domestica*) Gastrointestinal Anastomosis: Histological Incorporation and Alteration of Tensile Strength

81 MDG Clinical Research Laboratory

Capt Mark Lytle

Small bowel anastomotic leak and bleeding are potentially catastrophic complications after small bowel resection and anastomosis. Prior studies have shown to increase circumferential burst pressure by buttressing the anastomotic staple line. However, the questions of how staple line reinforcement agents affect staple line tensile strength or how they affect the intestine at a cellular level are still unclear. A pig model was used to create small bowel anastomoses using bioreinforcing agents with varying degrees of absorbability. These were then tested for tensile strength and examined under light and scanning electron microscopy. These techniques allow us to evaluate inflammatory changes, tensile strength, and tissue incorporation and remodeling that occurs with the use of bioreinforcing agents with small bowel anastomoses.

20. The Advanced Diagnostic Laboratory: Translational Research for the Warfighter

Eagle Applied Sciences

Dr. Jon McDonald

The mission of the Advanced Diagnostic Laboratory (ADL) is to test and develop emerging technologies for diagnostics and surveillance in order to transform medical capability to enhance prevention and control. The ADL tests the sensitivity and specificity of molecular assays for identification of pathogens of military significance. This is accomplished by monitoring military trainees at Lackland Air Force Base that have febrile respiratory illness through IRB-approved protocols. In addition to infectious diseases, the scope of the ADL includes chronic diseases that plague the military retiree and dependent populations. In its initial genetic testing study, the ADL is recruiting individuals treated at Wilford Hall Medical Center with type 2 diabetes mellitus (T2D). Although preventive measures can be implemented to reduce T2D onset, irregular work schedules, tours of duty in remote locations, and continuous changes in environment impose additional challenges that many military personnel face in maintaining healthy lifestyles. The consequences for T2D in the military setting include increased training costs due to medical discharge, and decreased skill-sets, knowledge, and experience within the military overall. The objective of the current study is to evaluate the prevalence of risk-associated genetic factors in T2D-patients as compared to nondiabetic controls. These data will be utilized to assess risk-conferring

genotypes in the young, healthy active-duty population to estimate the prevalence of risk-associated factors in our current and future war fighters. Identifying individuals at risk may ultimately delay onset through healthy lifestyle modifications and disease management programs.

21. Electrocardiographic changes in a model of critically ill cyanide toxicity

59th MDW Wilford Hall Medical Center (WHMC)

Dr. Vik Bebarta, Dr. Tylan Muncy

BACKGROUND: Cyanide is a commonly used terrorism weapon and is product of combustion in structural and vehicle fires in garrison. Previous rudimentary measurements have focused on a lactic acidosis. We have recently described hypotension and cardiovascular hemodynamics resulting from cyanide toxicity. OBJECTIVE: To evaluate the electrocardiographic (ECG) measurements, invasive brain tissue microdialysis metabolites, and noninvasive brain near infrared spectrometry (NIRS) as novel or bedside measurements of cyanide toxicity. METHODS: 24 swine were intubated and instrumented. A continuous cyanide infusion was started, until the development of severe hypotension (50% of baseline MAP). Animals were randomly assigned to intravenous or intraosseous hydroxocobalamin and monitored for 60 minutes after the start of antidotal infusion. Group size analysis based on a power of 80% yielded a sample size of 12 animals per group for comparison. RESULTS: We have interim analysis data. 1 animal in each arm died thus far. ECG findings were significant and showed ST depression and interval width changes. NIRS shows a significant declined during cyanide infusion and rise with antidote administration. Microdialysis collection is still in preparation. Samples has been collected but not completed. Preliminary animals showed a rise in brain acidosis. The animals developed hypotension, lactate acidosis, and recovery similarly to our previous models. CONCLUSION: We are evaluating novel and noninvasive measurements of cyanide toxicity. These measurements may be able to detect cyanide toxicity at the bedside rather than cyanide levels which cannot be routinely. In addition, these measurements may be able to prognosticate cyanide toxicity better than current methods.

22. Development of SAM based DNA biosensors for the detection of the hippuricase gene of Campylobacter jejuni using optical and electrochemical methods

81 MDG Clinical Research Laboratory

Maj Eric Olsen

Campylobacter jejuni is a significant cause of human bacterial gastroenteritis, Guillian-Barre syndrome, and reactive arthritis and Reiter syndrome. Detection using extraction methods, followed by serotype or genotype based diagnostic assays take up to 96 hours. Polymerase Chain Reaction (PCR) is very selective but is less sensitive, while electrochemical DNA microarrays produce high background signals. Fluorophore based sensing systems suffer from photo-bleaching. Additionally, the sensing platform is destroyed after each measurement. Reusability, reliability and robustness of the surface structures make Self-Assembled Monolayer (SAM) and hybridization based make optical sensing a better choice. Covalent linkages are employed to develop anti-fouling biosensor surface, often via thiol-gold linkages or avidin-biotin chemistries. We report the use of biotinylated and thiolated ssDNA probes to develop Diffraction Optics Technology (DOT) and SPREETA sensing platforms. Conformation changes and DNA hybridization on the surface is also monitored using Electrochemical Impedance Spectroscopy (EIS). Surface blocking effects are exerted by charged state of the probe that is immobilized on gold and also from the hybridization of target ssDNA with the probe. The key to improved efficiency in DNA hybridization is to develop an optimum surface density and chemistry minimizing non-specificity and increasing sensitivity. Mixed self-assembled monolayers (SAM) obtained from thiolated DNA and blocking thiols increases efficiency. DOT sensors had a detection limit of 5 nM while SPR sensors had a detection limit of 2.5 nM DNA with negligible change in SPR sensor sensitivity (~9.7 x 10-7 ΔRU).

23. Thoracic ultrasound can predict pneumothorax size in a cadaver model
59 EMDS

Capt Christopher Pitotti

OBJECTIVES: Thoracic ultrasound (TUS) is a fast and accurate way to diagnose a pneumothorax (PTX) in patients with thoracic trauma. METHODS: We instilled air into the extra-pleural space of 10 cadavers in 5% increments as calculated by chest CT, up to 50%. The presence of lung sliding was assessed at 11 locations and CT repeated after each insufflation. The mean and range of PTX size as detected by TUS was determined. Each anatomic location was correlated to the presence or absence of lung sliding to predict the best location to discriminate a PTX size of greater or less than 20% using a regression analysis. RESULTS: Induced PTX size ranged from 2 to 71%. On the right a PTX was first detected at the anterior axillary line at a mean PTX size of 13.7% (13.5% left); 35.9% at the mid axillary line (38.6% left); and 55.8% at the posterior axillary line (56.7% left). The presence or absence of lung sliding in the 6th intercostal space of the anterior axillary line was the best anatomic location to predict a PTX of greater or less than 20% on the right chest ($r=0.88$, $p<0.01$) and on the left chest ($r=0.56$, $p<0.01$). CONCLUSION: TUS can accurately predict the size of a PTX along anatomic lines of the chest wall in a cadaver model as confirmed by chest CT

(above previously orally presented at JSS April 2010)

24. Estimating hemothorax volume in cadaver model
59 EMDS

Capt Christopher Pitotti

OBJECTIVES: Emergency ultrasound is a fast and accurate way to diagnose a pleural effusion or hemothorax. An ultrasonographic method of determining effusion size has not been validated. Our objective was to determine if ultrasound could estimate pleural effusion size in a cadaver model. METHODS: We placed a supraclavicular catheter into each hemithorax of 8 intubated cadavers. A baseline CT was performed to determine initial pleural effusion size. An ultrasound exam was performed at the posterior axillary line in the 4th intercostal in the supine position. Measurement of extent of effusion from the chest wall to the visceral pleura was recorded after each subsequent instillation of 50 ml of normal saline up to 500 ml of instilled saline. A regression analysis was performed to determine a model to best correlate effusion size and this linear dimension. RESULTS: Pleural effusion size ranged from 0 to 1019 mL on the left and 0 to 922 mL on the right. Data for one cadaver on the right was excluded as an outlier. The linear regression model on the right had an r2 of 0.92 and on the left an r2 of 0.88. Pleural fluid volume determination on the right can be determined by the following equation, Vol (liters) =8.3 x distance from chest wall to lung lining (cm) – 0.02; and on the left, Vol (liters) = 5.6 x distance from chest wall to lung lining (cm) + 0.76. CONCLUSION: Ultrasound may be used to define pleural effusion size in a cadaver model.

25. A New Survivable Damage Control Model of Hypothermia, Hemodilution, and Liver Injury
86th MDS (AF member)

Maj/Dr. Bradley Putty

Intra-abdominal hemorrhage is a major cause of preventable mortality, and the liver is the most commonly injured solid organ. The mortality for high grade liver injuries can exceed 50%, with early deaths attributable to failure to control hemorrhage, frequently complicated by acidosis, hypothermia and coagulopathy. There is a need to effectively evaluate treatment durability and associated complications in high grade liver injuries.
Twenty Yorkshire swine underwent carotid and jugular cannulation for 35% blood volume reduction. A laparotomy was performed and core body temperature lowered to <35 °C. Ten animals underwent non-surgical liver injury, and ten underwent standardized AAST grade IV surgical injury. Shed blood was collected at 2 and 15 minutes, with packing at 2 minutes in the surgical injury. The abdomen was closed, and the animal was sacrificed at 48 hours. Serology

was performed at baseline, before and after liver injury, and thromboelastography (TEG) at baseline and post injury.
The model demonstrated decrease in MAP from 86.2 +/- 7.9 to 60.2 +/- 12.5 mmHg (p=0.001), decrease in temperature from 36.7 +/- .7 °C to 34.6 +/- .7 °C (p<0.0001), and survival of 70%. There were significant decreases in hemoglobin, platelets, and base excess with increases in lactate and anion gap levels. Both non-surgical and surgical injuries caused significant volumes of additional blood loss with 20% decreases in MAP following the surgical injury. TEG demonstrated a significant acceleration of initial clot formation and rapidity with similar clot strengths.
A swine survival model of lethal traumatic liver injury was successfully developed.

26. The Association of Binge and Heavy Drinking Patterns to Military Readiness
United States Air Force School of Aerospace Medicine (USAFSAM)

Maj Raymond Clydesdale

The negative outcomes from alcohol misuse have been chronicled for decades in epidemiological studies. Recent research has focused on patterns of drinking. Binge and heavy drinking have been associated with multiple negative outcomes, to include surrogate outcomes designed to measure decrements to military readiness. This study is perhaps the first to examine whether binge or heavy drinking patterns are associated with the U.S. military's overall inability to deploy rate or the individual reasons unable to deploy.

The prevalence of binge and heavy drinking and the inability to deploy rates were assessed from responses to the 2005 Department of Defense Survey of Health Related Behaviors Among Military Personnel. A secondary analysis of extant data resulted in a final sample size of 13,619 respondents who represented 847,253 active-duty military personnel. Multivariate models were fitted to examine the association between patterns of drinking and individual reasons for the inability to deploy.

Logistic regression showed no association of binge or heavy drinking to greater inability to deploy. Interestingly, individual reasons for the inability to deploy did show an association to include: Training, Dental Issue, No HIV Test, and Family Situation. There was no association noted for the individual reasons: Injury, Illness, Leave/Temporary Duty, or Other. Binge and heavy drinkers appear to be more susceptible to the psychosocial determinants as reasons for the inability to deploy.

27. Deployment Stressors and Job Performance: A Pilot Study
United States Air Force (SUAF), Nurse Corps

LtCol Cherri Shireman

PURPOSE/AIMS: The purpose of this focused ethnographic pilot study was to describe the deployers' perceptions of performing his duties/job while in garrison versus a war zone/deployed location to provide insight into the occupational stressors associated with military deployment. BACKGROUND: The stressors of military deployment have been linked to the deployment related illnesses reported by veterans of the Persian Gulf War, and OPERATIONS ENDURING AND IRAQI FREEDOM. Researchers have completed large numbers of studies investigating a possible link between military deployment stressors and adverse health outcomes. The focuses of these studies were on the health outcomes post deployment and not the actual deployment stressors associated with performing one's assigned duties. DESIGN: Salazar and Beaton's ecological model of occupational stress guided this exploratory ethnographic study. The research and interview questions were based upon the literature and the sensitizing framework. Research questions included the following: 1. What are the deployers' perceptions of the differences in performing their duties in garrison versus a war zone location? 2. What are the deployers' perceptions of the stressors in the war zone environment that alter or change the manner in which he or she performs their duties? DATA COLLECTION: Since active duty and former military members views may differ, only former military were recruited. Snowball sampling was used to recruit participants. Semi-structured face-to-face digitally recorded interviews, demographic questionnaires, and field notes were utilized to

collect data. The interviews were transcribed verbatim. DATA ANALYSIS: Emergent coding was utilized to identify and define coding categories from the transcribed interviews. Data were analyzed using content analysis and constant comparison. Ethnograph, v6.0, a data analysis software program, was utilized to organize data and assist with separating data into similar clusters for analysis. FINDINGS: The convenience sample included three male retired USAF enlisted members: 48-year-old aircraft electronic warfare technician, 42-year-old aeromedical craftsman, and 45-year-old utilities system superintendent. Participants had an average of 22.5 years of military service and at the time of the interview had been retired from military service for approximately 2.3 years. All three participants had deployed an average of three times and each of them had deployed in support of OPERATIONS IRAQI FREEDOM (OIF). Two of the three participants had deployed to forward areas/war zones. Four key themes that emerged from the data were doing the job, taking care, preparation strategies, and family impact. All participants stated that they were well trained to perform their job both in garrison and in a war zone. The differences between job performance in garrison and the war zone included the physical environment, mission, and work hours. Each participant acknowledged easily adapting to these differences. Taking care of their families, airmen, and lastly themselves was another prevailing theme reported by all participants. The most significant stressor reported by all, was time away from family, which resulted in missed family events and lost time that could never be recovered. All participants saw deployment as part of the job, and discussed specific ways in which they prepared themselves and their families for deployment. CONCLUSIONS: Retired senior enlisted military members with over 22 years of service identified time away from family as the most significant stressor of deployment. They reported easily and quickly adapting to the deployed work environment, and denied any impact on their job performance. Limitations include the small sample size of only males with many years of military experience. RECOMMENDATIONS: Further research is needed to explore the stress of deployment induced family separations, including the influence of previous deployments and years of military service. The results of this pilot study will be utilized to determine the content and structure for a larger qualitative study involving active duty USAF personnel. MILITARY NURSING RELEVANCE: Stressors of deployment may adversely affect the military members' health, influencing his or her ability to complete the mission. As military nurses work to ensure a healthy and fit force, it is essential that they have a better understanding of deployment related stressors. Today, as the U.S. government continues to maintain a high military operations tempo, the results of this pilot study and future research will be essential to military nursing, as the knowledge gained will help to identify mechanisms to prevent, modify, and minimize the negative health effects of deployment.

28. Evidence based combat casualty care: a case illustration of the GWOT vascular initiative research program

UK research fellow working with 59 MDW/ SSSOGV

Stannard A, Rasmussen TE, Burkhardt GE, Hancock HM, White JM, Spencer JR, Keltz B, Ivatury R, Williams K, Sharon D, Niemeyer D

BACKGROUND: Evidence based care in wartime requires a military-unique research program, the product of which must translate to lessen death and disability. The Global War on Terror Vascular Initiative (GWOTVI) is designed to channel questions encountered during vascular injury management to pathways for study. While validation rests in peer-reviewed publications and practice guidelines, real-time scenarios also provide substantiation. The objective of this report is to provide an account of vascular injury, examining the spectrum of care for the bearing of current research direction. METHODS: An individual case analysis of vascular injury from Operation Enduring Freedom (OEF) examining each level of care for directed surgical and adjunctive interventions. CASE DESCRIPTION: On 12 January 2010 a US Marine sustained popliteal artery injuries rendering both legs ischemic. At Camp Bastion (level IIE) flow was restored with temporary vascular shunts and fasciotomies

performed within 1 hour. The limbs were perfuse during MEDEVAC to Bagram Air Field (level III) where shunts were removed and repair performed using autologous vein. The negative pressure wound therapy (VAC™) adjunct was applied to the leg wounds. AIREVAC to CONUS (level V) was successful where limbs were viable and the Marine entered into GWOTVI for quality of life and limb survey. CONCLUSION: This account validates current posture of the GWOTVI program. All facets of care including international collaboration, early restoration of flow with vascular shunts, fasciotomy, definitive repair with vein, use of VAC™ and patient-based outcomes are areas of focus within the current research plan.

29. A Comparison of Manual Extraction Methods of Nucleic Acids for Real-Time PCR (RT-PCR) Detection

United States Air Force School of Aerospace Medicine (USAFSAM)/PHT, Brooks City-Base, TX

Clarise R. Starr, PhD, George F. Viale, MSgt, USAF, Linda S. Armstrong, MS, Elia Villazana-Espinoza, MS, Robert A. Alcorta, BS, Luis Perez, MS, and David L. Maserang, PhD.

INTRODUCTION: The JBAIDS real-time PCR assays utilize manual extraction to process many different types of matrices for RT-PCR detection. The Q-Flow detection kit that is currently used requires many processing steps and takes about 2.5 hours to extract 12 samples. A new kit, called the Platinum Path, has been introduced that takes about 1 hour to extract eight samples. Akonni Biosystems has developed an all-inclusive one-step pipette tip that can purify a sample in as little as 4 minutes without labor-intensive processes or hazardous organic extractions. The purpose of this effort was to compare the three different extraction procedures and their ability to successfully detect targets on the JBAIDS. METHODS: The Q-Flow 1-2-3, Platinum Path, and Akonni TruTip were used to extract high and low concentrations of B. globigii spores, E. herbicola, and MS2 spiked in various clinical, food, and environmental matrices. All protocols were performed according to package inserts, and extracts were tested on the JBAIDS using respective dry-down assays. RESULTS: Q-Flow performed the best, consistently having the lowest crossing point value on JBAIDS assays, except when tested on a 10% soil solution. TruTip performed as well as the Q-Flow in many conditions and, overall, was better than the Platinum Path in almost all conditions tested. Overall, Platinum Path performed the most inconsistently, especially when trying to detect a viral target. CONCLUSIONS: Our findings suggest that the use of the Akonni TruTip may be a viable option for a quicker manual extraction, saving time and money.

30. Evaluation of Rapid Point-of-Care (POC) Kits for Influenza A/B

United States Air Force School of Aerospace Medicine (USAFSAM)/PHT, Brooks City-Base, TX

Clarise R. Starr, PhD, Elizabeth M. Escamilla, MS, Rahdika Brown, SSgt, USAF, Roel F. Escobar, BS, Linda S. Armstrong, MS, Manuel Y. Caballero, BS, Elia Villazana-Espinoza, MS, and David L. Maserang, PhD

INTRODUCTION: The ability to rapidly and correctly diagnose influenza has proven challenging over the years due to the mutation frequency of the target virus and the many upper respiratory viruses that produce “flu-like” symptoms. There are many rapid influenza kits on the market that are configured for point-of-care (POC) testing, many variations of which are utilized by the USAF. The purpose of this effort was to evaluate the performance of these POC kits. METHODS: Five commercially available kits (BinaxNOW Influenza A&B, Remel X/pect Flu A&B, BD Directigen EZ Flu A+B, Quidel QuickVue Influenza Test, and 3M Rapid Detection Flu A+B Test) were tested against influenza A and B and negative patient samples. In addition, isolates were tested during the April 2009 outbreak to assess the robustness in detection of novel H1N1 strains. RESULTS: The POC kits were able to detect 34-60% of the influenza A positive samples, with a specificity range of from 15%-100%. Positive predictive value (PPV) and negative predictive value (NPV) of these kits were 58%-100% and 6% to

66%, respectively. The POC kits were able to detect 8-63% of the influenza B positive samples and had 14%-100% specificity. The PPV and NPV ranges were 29%-96% and 7%-78%, respectively. The five kits tested were unable to detect 3 of the 28 H1N1 culture strains tested. CONCLUSIONS: The negative predictive value of POC kits was quite low. Samples determined negative by a POC should be sent to a laboratory for confirmatory testing, based on the clinician's impressions.

31. Genomic Characterization of Human Adenovirus 36, a Putative Obesity Agent
CIF, 60MDG, Travis AFB, CA

MSgt Sarah Torres

Increased levels of serum antibody titers against Human adenovirus 36 (HAdV-D36) are associated with human obesity and experimental obesity in laboratory animals. While HAdV-D36 has been studied as an infectious agent implicated in obesity for over a decade, the complete genome sequence and its analysis have yet to be reported. A detailed analysis of the genome sequence of HAdV-D36 may be important to understand its role in obesity. Genomic and bioinformatic comparisons with other HAdVs identified differences that suggested unique functions. Global pair wise genome alignment with all sequenced Human adenovirus D (HAdV-D) genomes revealed areas of non-conserved sequences in the hexon, CR1(beta), CR1(gamma), and fiber genes. Phylogenetic analysis of all HAdV-D36 proteins confirmed that this virus belongs to species Human adenovirus D. HAdV-D36p stock was acquired and subsequently amplified in monolayers of A549 cells in 75 cm2 flasks for intracellular viral DNA extraction. Primers were designed based on conserved adenovirus sequences of types in HAdV-D and amplicons positive for the correct size were sequenced on an Applied Biosystems 3130x Genetic analyzer. The proteins and genes of HAdV-D36 were compared to homologs in other HAdV-D genomes. Percent identities between proteins of HAdV-D36 and other HAdVs were determined using Fasta3 [EBI] and Blastp software. This genomic analysis of HAdV-D36 provides an important tool for comprehending the role that this unique adenovirus may play in human obesity. Low amino acid sequence identity in the CR1 (beta) and CR1 (gamma) genes may suggest distinctive roles for these proteins. Furthermore, the predicted molecular models of the HAdV-D36 fiber protein seem to implicate a unique tissue tropism for HAdV-D36.

32. Rapid Detection of Novel H1N1 Influenza Virus by Real-Time RT PCR
CIF, 60MDG, Travis AFB, CA

MSgt Sarah Torres

The first case of influenza A H1N1 infection in the United States was reported by the Naval Health Research Center in mid-April 2009. Today, the new H1N1 virus has spread to over 160 countries. Thus, it is important to acquire reliable epidemiological data on the spread of this pandemic virus. To address this problem, we developed a real-time RT-PCR assay that detects a 122 base pair sequence in the haemagglutinin (HA) gene and a 131 base pair sequence in the neuraminidase (NA) gene. One hundred and twenty oropharyngeal swab specimens from the Naval Health Research Center, San Diego, CA were used to validate the new assay. The described assay detected nine of 30 confirmed H1N1 positive clinical isolates from respiratory disease outbreaks. The real-time RT-PCR assay had a wide dynamic range, detecting from 104 to 107 copies of genomic RNA per reaction. The assay did not cross-react with other influenza viruses, adenoviruses, respiratory syncytial virus, or common respiratory tract bacteria. The described assay is easy to use, sensitive and specific for the H1N1 assay in clinical throat swab specimens, and very rapid since turnaround time is less than two hours to obtain an answer.

33. Thawing of plasma which could be used in austere pre-hospital settings
59 MSGS

Capt Leslie Vojta

Trauma patients are at high risk for coagulopathy. Current doctrine calls for transfusing plasma as part of the initial resuscitation in addition to packed red cells. The

gold standard for thawing plasma is 15 minutes in the blood bank and 40 minutes for deployed Forward Surgical Teams. Medical providers have improvised many ways to thaw plasma en route to pick up casualties, including placing it inside body armor.

We obtained fresh frozen plasma (FFP) from the hospital blood bank and thawed it using a novel warming device. The first device was a commercially available Hypothermia Prevention & Management Kit (HPMK) which is available in the combat theater. It incorporates self-heating pads inside a nonconductive reflective layer. It is used to warm patients during transport. We placed the FFP inside the HPMK. The second device was a sleeve made from foil-lined insulating material also using self-heating pads. We monitored time to thaw FFP and used an` emergency nurse to confirm that it could be transfused.

The HPMK did not thaw the FFP to solution within 3 hours, but it had become a slushy. The novel device took 90 minutes to thaw to transfusability. The control (ambient air) remained frozen.

The novel device provided adequate thawing of plasma which could be used in austere pre-hospital settings. It does not surpass hospital grade water baths that can thaw FFP in 15 minutes.

34. Local tissue effects of topical hemostatic agents in a swine survival model of hepatic injury

CIF, 60MDG, Travis AFB, CA

Capt Geoffrey Douglas

INTRODUCTION: Hemostasis of liver injuries can be achieved with the use of topical agents and surgeons can choose from numerous absorbable or non-absorbable materials. In this study we compared the short term histological effects of various hemostatic agents in a swine model of nonlethal hepatic injury. METHODS: Nine swine were anesthetized and prepared for surgery using standard methods. A small midline laparotomy incision was used to expose the liver, and ten 1.4cm punch biopsies were made on the diaphragmatic surface. Each biopsy site was randomly assigned to receive one of ten hemostatic agents. These included: chitosan, Combat Gauze TM, regular gauze, Stasilon®, Surgicel™ (to be removed 2 days later), Surgicel™ (to be left in place), WoundStatTM, Avitene, thrombin soaked gel foam or electrocautery. RESULTS: Bleeding from the liver biopsy sites was usually controlled by a single application of each agent. When liver packing and hemostatic agents were removed at 48 hours, there was little re-bleeding, which was usually controlled by application of spray thrombin. Histologic analysis indicated that hemorrhage, necrosis and clotting were more pronounced in the earlier time points. All agents induced similar amounts of fibrosis and inflammatory changes that increased with time. The absorbable hemostatic agents were more likely to form abscesses and were associated with more debris and granulomatous changes than those that required removal. WoundStat caused severe tissue necrosis but was associated with less hemorrhage and clotting than other agents. Electrocautery produced severe initial necrosis, but was comparable to other agents by two weeks.

35. Evaluation of A Kaolin Impregnated Hemostatic Dressing (Combat Gauze™) In A Large Animal Model (Sus scrofa) Of Severe Hepatic Injury

CIF, 60MDG, Travis AFB, CA

Capt Geoffrey Douglas

INTRODUCTION: In the most severe liver injuries, hypothermia and coagulopathy coexist and are highly lethal. Management frequently involves the use of topical hemostatic agents combined with perihepatic packing. Kaolin-impregnated gauze or Combat GauzeTM (CG) is a new hemostatic dressing that has demonstrated significant potential for hemorrhage control in external wounds. The objective of this study was to determine the efficacy of CG in controlling severe hemorrhage in hypothermic, coagulopathic swine with severe hepatic injury. METHODS: Anesthetized animals underwent splenectomy and were cooled to 32°C while undergoing a 60% volume per volume exchange transfusion using Hextend. A Grade V liver injury was created in the right middle hepatic

lobe. All animals were allowed to freely bleed for 30 seconds, then randomized to treatment with CG or standard laparotomy pads to the injury site. RESULTS: There was no difference between groups in preinjury parameters. Animals packed with CG demonstrated significantly less blood loss when compared to standard laparotomy packing (control=41.6ml/kg, treatment=23.9ml/kg, p=0.05). There was a trend towards lower resuscitation requirements in the CG group (control=31.3ml/kg. treatment=4.7ml/kg, p=0.06) and no statistically significant difference in mortality (control =43%, treatment=14%, p=0.24). Histology of the injury sites showed more adherent clot in the CG group, but no obvious tissue destruction. CONCLUSION: In severe hepatic injury Combat GauzeTM reduced blood loss and improved resuscitation when compared with standard gauze, apparently without tissue damage. We conclude that Combat Gauze™ may be safe and effective for internal use.

36. The Effect of Negative Pressure Wound Therapy on Eluted Antibiotic Concentrations from Antibiotic Impregnated Polymethylmethacrylate Beads Implanted in a Simulated Porcine Open Femur Fracture Model

CIF, 60MDG, Travis AFB, CA

Capt Geoffrey Douglas

INTRODUCTION: Antibiotic impregnated polymethylmethacrylate (PMMA) beads and negative pressure wound therapy are frequently used to treat open fractures that are at risk of infection. Data on their use in conjunction with each other is minimal. The effect of negative pressure wound therapy on the decay rate of local wound antibiotic concentrations has not been defined. The objective of the study is to evaluate the effect of negative pressure wound therapy on the concentration of vancomycin and tobramycin in the tissue fluid surrounding simulated femur fractures in a porcine model. METHODS: Under general anesthesia 10 X 4mm corticotomies were made midshaft on the lateral aspects of both femurs. Equal volumes of polymethylmethacrylate beads containing vancomycin and tobramycin were placed around the corticotomy. In each pig, one wound was closed in layers; the opposite wound was treated with negative pressure wound therapy with the sponge placed either in direct contact with the beads or superficial to reapproximated fascia lata. The antibiotic concentration in the wound fluid was measured every 12 hours for 72 hours. RESULTS: There were 20 animals tested with 10 in each group. The rate of decay of antibiotic was similar in each group. At 72 hours the tobramycin level was consistently above the typical minimum inhibitory concentrations (MIC) in both groups (control=25.32 µg/ml, closed fascia = 20.38 µg/ml, open fascia=25.21 µg/mL; $p>0.05$). We conclude that negative pressure wound therapy used in conjunction with antibiotic impregnated PMMA beads will not adversely affect drug concentrations in wounds.

Appendices

Appendix A. AFMS Medical Research Symposium Agenda

AFMS Medical Research Symposium Agenda

TUESDAY, August 24, 2010

7:30 am – 8:30 am		**Registration (Crystal Ballroom Foyer)**
8:30 am – 8:45 am	**Plenary Session (Salon A/B)**	**SGRS Welcome: Col Don White, Director, Research and Development**
8:45 am - 9:15 am		**SGR Welcome: Brig Gen James Carroll, Commander, Air Force Medical Support Agency**
9:15 am – 9:45 am		**Deputy Assistant Secretary of Defense for Force Health Protection & Readiness: Dr. Peach Taylor**
9:45 am – 10:00 am		**Break (Salon C)**
10:00 am – 10:30 am		**Defense Medical Research and Development Program (DMRDP)** **COL Dallas Hack, Director, US Army Combat Casualty Care Research Program**
10:30 am – 11:15 am		**Armed Forces Institute of Regenerative Medicine (AFIRM): LTC Brian Moore, Program Manager**
11:15 am – 11:30 am		**Defense Technical Information Center (DTIC): Ms. Shari Pitts, Information Collection Division**
11:30 am - 1:00 pm		**Lunch Break**

	Operational and Medical Track (Salon A)	**Enroute Care Track (Wilson/Harrison)**	**Force Health Protection Track (Salon B)**	**Nursing Track (Jackson)**
1:00 pm - 1:30 pm	Attenuation of Altitude De-acclimatization/ Neocytolysis with Exercise Intervention **(Lt Col Michael Brothers)**	Optimal User Interface for Remote En-Route Care Patient Monitoring **(Dr. Richard Bucholz)**	A Novel Approach to Zoonotic Population Health Monitoring: The Zoonoses Integration Project **(Maj Thomas Doker)**	Secondary Insults of Traumatic Brain Injury in CCATT Patients Returning from Iraq/Afghanistan **(Maj Susan Dukes)**
1:30 pm - 2:00 pm	Impact of Alternating Days of Intermittent Hypoxic Exposure (IHE) on Physical and Cognitive Performance **(Lt Col Michael Zupan)**	Vascular Injury Rates from the Wars in Iraq and Afghanistan **(Lt Col Todd Rasmussen)**	Hydroxocobalamin and Epinephrine Each Improve Survival in a Novel Swine Model of Cyanide-Induced Cardiac Arrest: A Randomized Trial **(Maj Vik Bebarta)**	Iron Status of Deployed Military Members **(Maj Candy Wilson)**
2:00 pm - 2:30 pm	Altitude-related Differences in Running Economy among Sea Level Residents during 46 Weeks at Moderate Altitude **(Dr. Jeff Nelson)**	Direct Vascular Control Results in Less Physiologic Derangements than Aortic Crossclamping in a Porcine Model **(Capt Nick Markov)**	Cold Injury in Military Population: Current Trends and Comparison to Past Conflicts with Current Research **(Capt Andrew Hall)**	Air Force Nurse Transition Program **(Col Robie Hughes)**
2:30 pm - 2:45 pm	**Break (Salon C)**			

	Operational and Medical Track (Salon A)	Enroute Care Track (Wilson/Harrison)	Force Health Protection Track (Salon B)	Nursing Track (Jackson)
2:45 pm - 3:15 pm	AFRRI's history, mission, and current research and education programs **(Maj Michael Dempsey)**	Hemorrhagic Shock Worsens Neuromuscular Recovery in a Porcine Survival Model of Ischemia/Reperfusion Injury **(Capt Heather Hancock)**	The Association Between Stress and Physical Fitness Testing in the 2005 Department of Defense Population Survey **(Lt Col Valerie Johnson)**	Inpatient Glycemic Management Team at Wilford Hall Medical Center **(Ms. Stacey Ward)**
3:15 pm - 3:45 pm	A Model Graduate Medical Education Military Unique Training Program **(Lt Col Vinod Gidvani-Diaz)**	Quality of limb salvage following wartime extremity vascular injury: results of a novel patient-based outcomes study **(Lt Cdr Adam Stannard (Royal Navy))**	The Error Rate of the Pushup Component of the USAF Fitness Assessment **(Maj Eric Wilson)**	Diabetes Self-Management Education at a Military Hospital **(Ms. Ellen Kilpatrick)**
3:45 pm - 4:15 pm	An Overview of Combat Wound Initiative Program and Biosurveillance Efforts at Armed Forces Institute of Pathology **(Dr. Mina Izadjoo)**	Traveling Fellowship to the United Kingdom as an adjunct to general surgical research and training **(Lt Cdr Adam Stannard (Royal Navy))**	Effects of sit-up training versus core stabilization exercises on sit-up performance: A cluster randomized trial **(Lt Col John Childs)**	Nursing Roundtable **(Col Karen Weis/Ms. Cindy Petit)**
4:15 pm - 5:00 pm	**Break (Salon C)**			
5:00 pm - 8:00 pm	**AFMS Medical Research Symposium Social and Poster Session (Potomac View): Presenter Q&A 5:00 pm – 6:30 pm**			

WEDNESDAY, August 25, 2010

	Operational and Medical Track (Salon A)	En-Route Care Track (Wilson/Harrison)	Force Health Protection Track (Salon B)
8:00 am – 8:30 am	Glucose Control in Critically Ill Adults at a Military Hospital **(Maj Brian Allenbrand)**	Enhancement in Communication of Performance Improvement Events within a Global Military Trauma System **(Ms. Kathleen Martin)**	Embedded Fragments - A Unique Exposure Situation and Concerns of Possible Health Effects **(Dr. Jose Centeno)**
8:30 am – 9:00 am	Management and Treatment of Pediatric Obesity in a Military Outpatient Setting **(Dr. Jodi Krall)**	Local Hemostatic Agents in a Survival Model of a Lethal Porcine Liver Injury **(Maj Bradley Putty)**	The Evaluation of Nanoparticles as Biological Decontaminants **(Dr. Clarise Starr)**
9:00 am – 9:30 am	Budget Impact Analysis of Bariatric Surgery for Morbid Obesity **(Dr. Rafael Alfonso)**	Affect of Altitude on Extremity Compartment Syndrome (ECS) **(Dr. John Kalns)**	Toxicology & ESOH Issues of Engineered Nanomaterials **(Dr. Saber Hussain)**
9:30 am – 9:45 am	**Break (Salon C)**		
9:45 am – 10:15 am	Pilot Study of A Diabetes Prevention Program in A Military Community **(Capt Lisa Strickland)**	Bacterial Growth at Altitude **(Capt Ryan Earnest)**	Evaluation of Jet Fuel Induced Hearing Loss in Rats **(Dr. David Mattie)**

	Operational and Medical Track (Salon A)	Enroute Care Track (Wilson/Harrison)	Force Health Protection Track (Salon B)
	Operational and Medical Track (Salon A)	**Enroute Care Track (Wilson/Harrison)**	**Force Health Protection Track (Salon B)**
10:15 am – 10:45 am	Decreased Blood Glucose Levels Among Metformin Dependent Diabetics Undergoing Hyperbaric Oxygen Treatment **(Maj Todd Huhn)**	Technical Evaluation of Enroute Care Mechanical Ventilation **(SMSgt Dario Rodriquez)**	Toxicity and Health Hazard Assessment for Synthetic Paraffinic Kerosene **(Dr. David Mattie)**
10:45 am – 11:15 am	Team Based Approach to Diabetes Care **(Lt Col Mark True)**	Joint Medical Distance Support and Evacuation (JMDSE), Joint Capability **(CDR Greg Cook)**	Cellular Bioeffects Thresholds for Terahertz Frequency **(Dr. Gerald Wilmink)**
11:15 am – 12:45 pm	**Lunch Break**		
12:45 pm – 1:15 pm	The Effect of Special Duty Subpopulations on the Prevalence of Secretive Behaviors in the USAF **(Col Mary Brueggemeyer)**	Field Intravenous Fluid Reconstitution (FIVR) **(Lt Col Steven Stern)**	Development of a Health-Belief-Model-Based Instrument to Assess Worker Beliefs about using PPE **(Lt Col Jack Wall)**
1:15 pm – 1:45 pm	The Association Between Mental Health and Cigarette Smoking in Active Duty Military Members **(Maj Erich Schroeder)**	A comparison of proximal tibia, proximal humerus and distal femur infusion rates under high pressure using the EZ-IO Intraosseous device on an adult swine model **(Maj Julio Lairet)**	Nucleic Acid and Protein Detection Technology: Limitations, Milestones, and the Continuous Search for the Holy Grail **(Dr. Clarise Starr)**
1:45 pm – 2:15 pm	The Association Between Mental Health and Hypertension in the 2005 DoD Population Survey **(Lt Col Scott Zaleski)**	Inflammation Following Hemorrhage and AE **(Dr. Tim Pritts)**	Upper Respiratory Virus Serotype Panel for the Pyrosequencer **(Dr. James Baldwin)**
2:15 pm – 2:30 pm	**Break (Salon C)**		
2:30 pm- 3:00 pm	Psychosocial Stress of RPA Operators **(Dr. Wayne Chappelle)**	MAF Aircrew Fatigue Countermeasures Survey **(Col Karen Klingenberger)**	The Use of Retinal Photographs For AFSOC Flyers at Risk For Laser Eye Injuries: Evaluation as Screening Exam **(Lt Col Chris Hudson)**
3:00pm – 3:30 pm	Factor Analysis of MAB-II Neuropsychological Screening in Rated USAF Pilots **(Maj Bret Heerema)**	**Enroute Care Roundtable (Wilson/Harrison) (Air Mobility Command/Mr. Calvin Griner)**	Visual Performance Enhancement with Macular Pigment in Glare Condition **(Dr. Leon McLin)**

3:30 pm - 4:00 pm	Risk of Prostate Cancer in USAF Aviators **(Lt Col Dave Rogers)**		Identification of Serum Biomarkers of Directed Energy Induced Retinal Injury **(LTC Deborah Whitmer)**
4:00 pm - 4:15 pm	**Break (Salon C)**		
	Operational and Medical Track (Salon A)	**Enroute Care Track (Wilson/Harrison)**	**Force Health Protection Track (Salon B)**
	4:15 pm - 7:00 pm (Salon A) Air Force Institutional Review Board Roundtable (Lt Col Robert Kang/Ms. Jessica Candia) BY INVITATION ONLY	**4:15 pm-7:00 pm (Wilson/Harrison) Enroute Care Roundtable (cont)** (Air Mobility Command/Mr. Calvin Griner)	**4:15 pm - 7:00 pm (Salon B) Force Health Protection Roundtable** (Maj Colby Adams/Dr. Welford Roberts)
7:05 pm - 10:00 pm	**Washington Nationals vs. Chicago Cubs (Nationals Ballpark)**		

THURSDAY, August 26, 2010

8:00 am - 8:30 am	PLENARY SESSION (Salon A/B)	**Blood Pharming: Dr. Stewart Abbot, Celgene Cellular Therapeutics**
8:30 am - 9:00 am		**Mild Traumatic Brain Injury and Sleep: Dr. Michael Russo, Traumatic Brain Injury Neurologist**
9:00 am - 9:30 am		**Defense Centers of Excellence (DCoE): Dr. George Johnson, TBI Directorate**
9:30 am - 9:45 am		**Break (Salon C)**
9:45 am - 10:15 am		**DoD "Use of Laboratory Animals" Updates: COL Annette Hildabrand, Deputy Director, Animal Use Programs**
10:15 am - 10:45 am		**Simulation Training Research- Trauma Man: Capt Andrew Hall, 81 MDG**
10:45 am - 11:15 am		**Joint Technical Coordinating Group (JTCG) Updates: Col Ray Santullo, Air Force Liaison to JTCG**

11:15 am - 11:30 am		**Break (Salon C)**
11:30 am - 12:00 pm		**Leadership Brief: Lt Gen Bruce Green, Air Force Surgeon General**

Additional Meetings			
Monday, 23 August 2010	**Tuesday, 24 August 2010**	**Wednesday, 25 August 2010**	**Thursday, 26 August 2010**
12:00 pm – 5:00 pm **(Washington Ballroom)** **Medical Modernization/ Research Management Working Group** **BY INVITATION ONLY**	**5:00 pm – 8:00 pm** **(Potomac View)** **AFMS Symposium Social Poster Session** **Casual Attire** **For All Attendees and Guests**	**1:00 pm – 7:00 pm** **(Potomac View)** **Diabetes Fuchsia Plan Roundtable** **BY INVITATION ONLY**	**1:00 pm – 3:00 pm** **(Wilson)** **Clinical Investigation Facility Quarterly Meeting** **BY INVITATION ONLY**
Exhibits and Tables		**Available Rooms**	
CME/CNE/CEU **Military Vaccine Agency (MILVAX)** **Arlington Convention and Visitors Association**		**DV Executive Suite (Boardroom)** **Speaker Ready Room (Lincoln Hall)**	

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Appendix C. Continuing Education

This year the symposium granted Continuing Medical Education (CME) and Continuing Nursing Education (CNE) credits for the scientific presentations. Each presentation was worth 0.5 credits. The symposium also granted education credits for Sanitarians and Environmental Health Professionals (Registered Sanitarians [R.S] and Registered Environmental Health Specialists [R.E.H.S.]) from the National Environmental Health Association (NEHA), and Certified Industrial Hygienists (C.I.H.) from the American Board of Industrial Hygiene (ABIH).

Appendix D.

Keeping Our Promise Through Medical Research and Development

Dr. Peach Taylor
Deputy Assistant Secretary of Defense for Force Health Protection & Readiness

Keeping Our Promise Through Medical Research and Development

5th Annual Air Force Medical Research Symposium
August 24, 2010

Dr. George Peach Taylor
Deputy Assistant Secretary of Defense
for Force Health Protection & Readiness

"No Higher Priority"

"Beyond waging the wars we are in, treatment of our wounded, their continuing care, and eventual reintegration into everyday life is my highest priority.

"I consider this a solemn pact between those who have risked and suffered, and the Nation that owes them its eternal gratitude."

Robert M. Gates
Secretary of Defense

Force Health Protection and Readiness

Shapes defense-wide health care and deployment medical support capabilities to improve, protect, and conserve the health and resilience of Service members for optimal mission performance across global military activities and operations.*

*Joint FHP CONOPS

FHP&R Program Directorates

FHP&R is responsible for military health care policy and is comprised of nine Program Directorates:

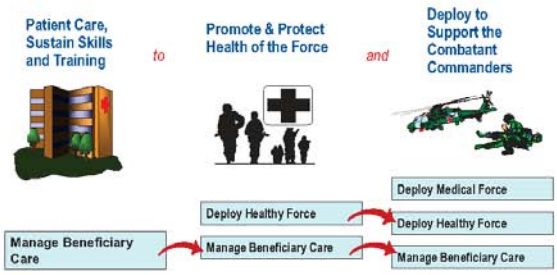
- Civil – Military Medicine
- Force Readiness and Health Assurance
- Medical Logistics
- Deployment Technologies and Support Programs
- Defense Health Program Medical Research and Development
- Operational Medicine and Medical Force Readiness
- International Health
- Medical Countermeasures
- Psychological Health

The Military Health System

The MHS is a large and complex organization

- **Integral component of America's fighting forces** – and a military medical system unlike any other in the world
- **A hospital system** – 59 hospitals worldwide
- **An integrated medical system** – 364 medical clinics, 282 dental clinics
- **An education, training and research institution**
  - Medical school and graduate programs
  - 36 medical research laboratories
  - Scholarship programs across most major universities
  - Comprehensive medical research & development programs
- **A health insurance plan**
  - 9.6 million covered lives
  - Over 300,000 network providers

Military Health System Mission – Peacetime and Wartime



Continuum of Care

DHP Medical Research and Development

- Develops R&D planning, programming, budgeting, and execution strategies
- Communicates guidance to organizations using DHP RDT&E funds
- Focal point for all DHP medical R&D actions and communications.

Strategic Drivers of "Enhanced" Medical Research & Development Funding

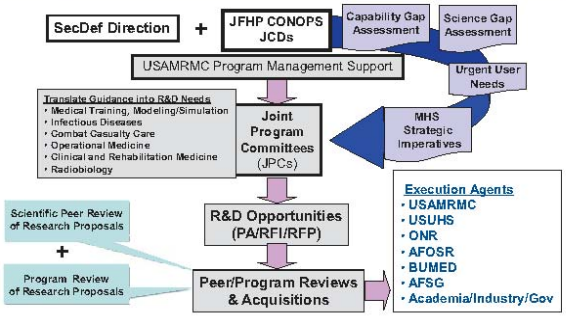
"I request the development of a tailored plan to provide R&D investments that advance state-of-the-art solutions for world class medical care with an emphasis on Post Traumatic Stress Disorder, Traumatic Brain Injury, Prosthetics, Restoration of Sight & Eye-Care, and other conditions directly relevant to the injuries our soldiers are currently receiving on the battlefield."

Secretary of Defense Robert Gates
June 26, 2008

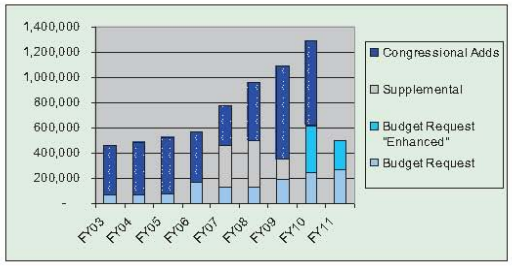
Capabilities – Based Assessment

Capability gaps identified from Joint Capability Documents/Functional Needs Assessments

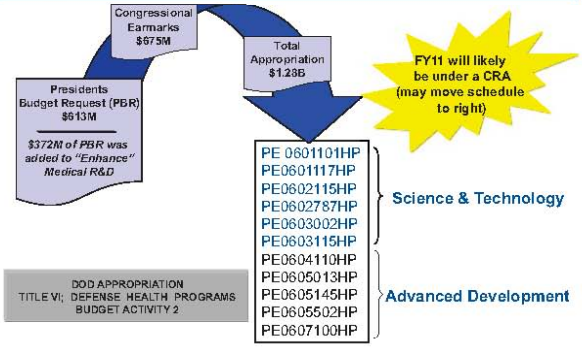
Execution Process for Medical Research and Development "Enhanced" Program



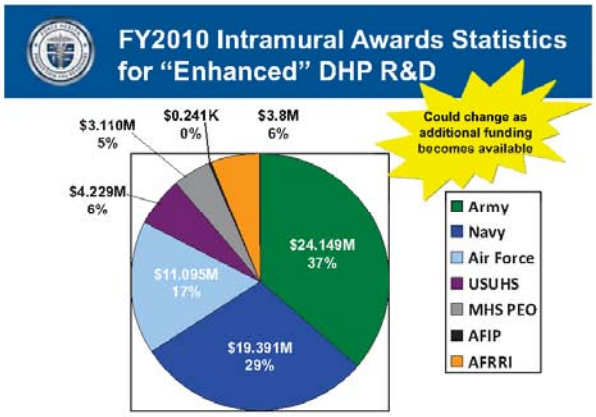
Defense Health Program RDT&E Funding



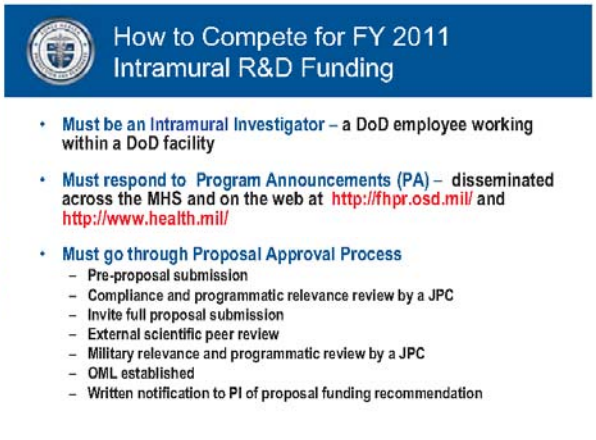
Scope of Defense Health Program Research and Development Funding for FY 2010




Major Program Areas of Medical Research and Development
FY 2010 Appropriation (Includes Congressional Marks)
Clinical and Rehabilitation Medicine
Regenerative Medicine
Neuromusculoskeletal Injury
Acute/Chronic Pain Mgmt
Sensory System Injury
Cancer
Muscular Dystrophy
Multiple Sclerosis
Autism
Diabetes
$500M
Military Operational Medicine
Mild Traumatic Brain Injury
Injury Prevention & Reduction
Psychological Health & Resilience
Physiological Health
Environmental Health & Protection
$350M
Health IT, Medical Training and Simulation
EHR Applications
Med-Surgical Simulation Technologies
Skills Retention/Transference Re-entry
$175M
Radiation Health Effects
Diagnostic Biodosimetry
Countermeasures
- Protection
- Treatment
$10M
Combat Casualty Care
Damage Control Resuscitation
Penetrating Traumatic Brain Injury
Combat Trauma Therapies
Health Monitoring & Diagnostic Technology
$200M
Infectious Diseases
Wound Infection
- Prevention
- Management
- Treatment
Pathogen Detection
HIV Prevention
H1N1 Diagnostics
$50M
Actual values subject to scientific/program review of proposals, awards & research support costs


FY2010 Intramural Awards Statistics
for "Enhanced" DHP R&D
Could change as additional funding becomes available
$3.110M 5%
$0.241K 0%
$3.8M 6%
$4.229M 6%
$24.149M 37%
$11.095M 17%
$19.391M 29%
Army
Navy
Air Force
USUHS
MHS PEO
AFIP
AFRRI


Funding Opportunities for the "Enhanced" Part of the DHP R&D Program
Medical R&D Development
Diagnosis and Treatment of Brain Injury
Polytrauma and Blast Injury
Infectious Diseases
Radiobiology
Operational Health and Performance
Rehabilitation
Psychological Health and Well-Being for Military Personnel and Families
Medical Training Systems, Modeling and Simulations
Polytrauma & Blast Injury
Evacuation Applications. Applied research leading to advanced, automated, and portable medical systems for forward critical care and ground and aeromedical patient transport including but not limited to closed-loop control of delivery of life support interventions (i.e., ventilation, oxygen, and fluids) and advanced litter technologies to reduce impact of G-forces and vibration on casualties.


How to Compete for FY 2011
Intramural R&D Funding
Must be an Intramural Investigator – a DoD employee working within a DoD facility
Must respond to Program Announcements (PA) – disseminated across the MHS and on the web at http://fhpr.osd.mil/ and http://www.health.mil/
Must go through Proposal Approval Process
Pre-proposal submission
Compliance and programmatic relevance review by a JPC
Invite full proposal submission
External scientific peer review
Military relevance and programmatic review by a JPC
OML established
Written notification to PI of proposal funding recommendation

BRAC: Creating Research Centers of Excellence

- **Battlefield Health and Trauma Research** at Fort Sam Houston, TX
- **Infectious Disease Research** at Walter Reed, Forest Glen, MD
- **Aerospace Medicine Research** at Wright Patterson AFB, OH
- **Joint Biomedical Research, Development and Acquisition Management Center** at Fort Detrick, MD.
- **Medical Biological Defense Research** at Fort Detrick, MD
- **Chemical Biological Defense Research, Development & Acquisition** at Aberdeen Proving Ground, MD

"No Higher Priority"

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"I consider this a solemn pact between those who have risked and suffered, and the Nation that owes them its eternal gratitude."

Robert M. Gates
Secretary of Defense

Keeping Our Promise Through Medical Research and Development

5th Annual Air Force Medical Research Symposium
August 24, 2010

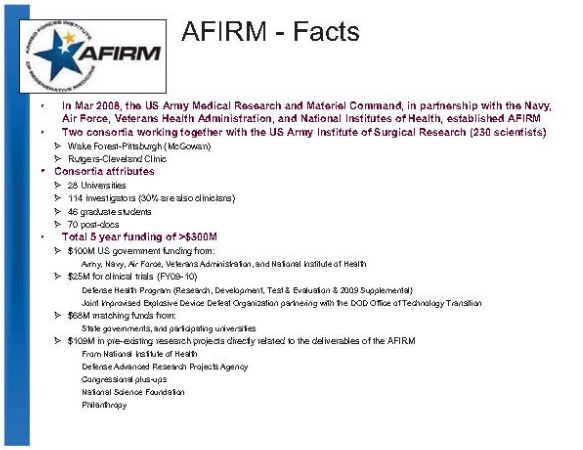
Dr. George Peach Taylor
Deputy Assistant Secretary of Defense
for Force Health Protection & Readiness

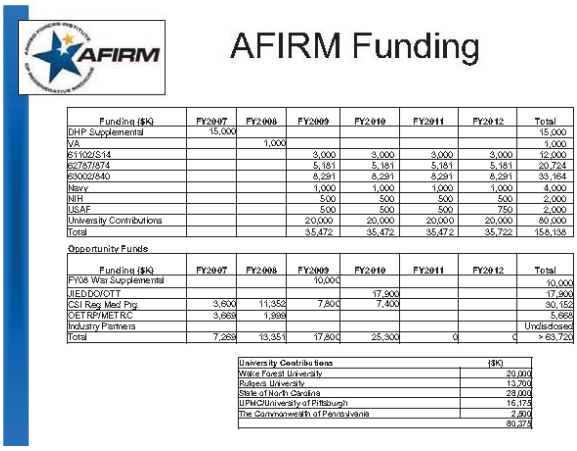
Appendix E.

Armed Forces Institute of Regenerative Medicine (AFIRM)

LTC Brian Moore
Program Manager


AFIRM
ARMED FORCES INSTITUTE OF REGENERATIVE MEDICINE
AFIRM
Our Science for Their Healing
AFMS Medical Research Symposium
LTC Brian D. Moore
Deputy Project Director, Armed Forces Institute of Regenerative Medicine
The opinions and views expressed in this presentation are those of the author and not necessarily endorsed by the U.S. Army.
www.afirm.mil


AFIRM
AFIRM - Facts
In Mar 2008, the US Army Medical Research and Material Command, in partnership with the Navy, Air Force, Veterans Health Administration, and National Institutes of Health, established AFIRM
Two consortia working together with the US Army Institute of Surgical Research (230 scientists)
Wake Forest-Pittsburgh (McGowan)
Rutgers-Cleveland Clinic
Consortia attributes
28 Universities
114 investigators (30% are also clinicians)
46 graduate students
70 post-docs
Total 5 year funding of >$300M
$100M US government funding from:
Army, Navy, Air Force, Veterans Administration, and National Institute of Health
$25M for clinical trials (FY09-10)
Defense Health Program (Research, Development, Test & Evaluation & 2009 Supplemental)
Joint Improvised Explosive Device Defeat Organization partnering with the DOD Office of Technology Transition
$68M matching funds from:
State governments, and participating universities
$109M in pre-existing research projects directly related to the deliverables of the AFIRM
From National Institute of Health
Defense Advanced Research Projects Agency
Congressional plus-ups
National Science Foundation
Philanthropy


AFIRM
AFIRM Funding
Funding ($K) FY2007 FY2008 FY2009 FY2010 FY2011 FY2012 Total
DHP Supplemental 15,000 15,000
VA 1,000 1,000
S1102/S14 3,000 3,000 3,000 3,000 12,000
S2757/874 5,181 5,181 5,181 5,181 20,724
S3002/840 8,291 8,291 8,291 8,291 33,164
Navy 1,000 1,000 1,000 1,000 4,000
NIH 500 500 500 500 2,000
USAF 500 500 500 750 2,000
University Contributions 20,000 20,000 20,000 20,000 80,000
Total 35,472 35,472 35,472 35,722 158,138
Opportunity Funds
Funding ($K) FY2007 FY2008 FY2009 FY2010 FY2011 FY2012 Total
FY08 War Supplemental 10,000 10,000
JIEDDO/OTT 17,900 17,900
CSI Reg Med Prg 3,600 11,352 7,800 7,400 30,152
OETR?METRC 3,669 1,989 5,658
Industry Partners Undisclosed
Total 7,269 13,341 17,800 25,300 0 0 > 63,720
University Contributions ($K)
Wake Forest University 20,000
Rutgers University 13,700
State of North Carolina 28,000
UPMC/University of Pittsburgh 15,175
The Commonwealth of Pennsylvania 2,800
89,375


AFIRM
AFIRM Partnership is a net-centric organization
US Army Institute of Surgical Research
Wake Forest – Pittsburgh
The Wake Forest Institute for Regenerative Medicine (NIC)
The McGowan Institute for Regenerative medicine (Univ. of Pittsburgh)
Allegheny Singer Research Institute
Carnegie Mellon University
Georgia Tech University
Institute for Collaborative Biotechnology (ICB) that includes UC Santa Barbara, MIT and Caltech
Oregon Medical Laser Center
Stanford University
Rice University
Tufts University
University of California, Berkeley
University of Texas Health Sciences Center-Houston
University of Wisconsin
Vanderbilt University
Rutgers – Cleveland Clinic
Rutgers /New Jersey Center for Biomaterials
Cleveland Clinic Foundation
Carnegie Mellon University
Case Western Reserve University
Dartmouth Hitchcock Medical Center
Massachusetts General Hospital / Harvard Medical School
Massachusetts Institute of Technology
Mayo Clinic College of Medicine
Northwestern University
State University of New York at Stony Brook
University of Cincinnati
University of Medicine and Dentistry of New Jersey
University of Pennsylvania
University of Utah
University of Virginia
Vanderbilt University

Top US Publishers (2001-2007)

Stem Cells for Regenerative Medicine and Tissue Engineering

US Rank	University	In AFIRM
1	Harvard	Y
2	MIT	Y
3	Univ. Pittsburgh	Y
4	Columbia Univ.	
5	Tufts	Y
6	Georgia Tech	Y
7	Rice	Y
8	Stanford	Y
9	Case Western	Y
10	Johns Hopkins	

US Rank	Researcher	In AFIRM
1	David Kaplan	Y
2	Rocky Tuan	Y
3	Robert Langer	Y
4	Gordana Vunjak-Novakovic	
5	Johnny Huard	Y
6	Michael Longaker	Y
7	Jeffrey Gimble	Y
8	Joseph Vacanti	Y
9	Anthony Atala	Y
10	Antonios Mikos	Y

From: World Technology Evaluation Center Report: International Assessment of Research and Development in Stem Cells for Regenerative Medicine and Tissue Engineering, MAR 2008

Creation and Mission

- **Department of Defense established the AFIRM in 2008**
- **Mission: *To develop and accelerate regenerative solutions for the treatment of battlefield injuries, including:***
  - Research and development of new therapies and regenerative products
  - Coordination of innovative clinical trials
  - Outreach to the community of wounded service members, veterans, and their families
    - ➢Web
    - ➢Personal meetings
  - Outreach to the DoD medical community
    - ➢Grand Rounds
    - ➢Traveling Fellows Program (TFP)
    - ➢Collaboration with the ISR and other intramural DoD organizations

Five Major Programs

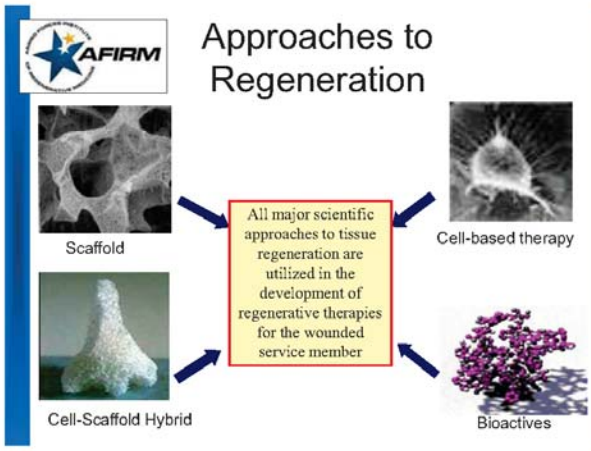
Wake Forest-Pittsburgh & Rutgers Cleveland Clinic Consortium Regenerative Medicine Programs

- Craniofacial Regeneration
- Burn
- Compartment Syndrome
- Limb and Digit Regeneration
- Scarless Wound Healing

Translate Technologies

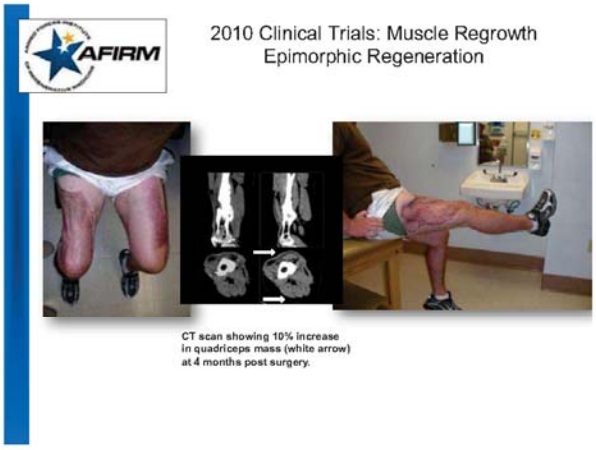
Proof of Concept	Pre-Clinical Research	Clinical Trial
• (TRL 2-4)	• (TRL 4-5)	• (TRL 5+)

Metric for Success Is Get It to the Patient


AFIRM
Approaches to Regeneration
Scaffold
Cell-based therapy
All major scientific approaches to tissue regeneration are utilized in the development of regenerative therapies for the wounded service member
Cell-Scaffold Hybrid
Bioactives

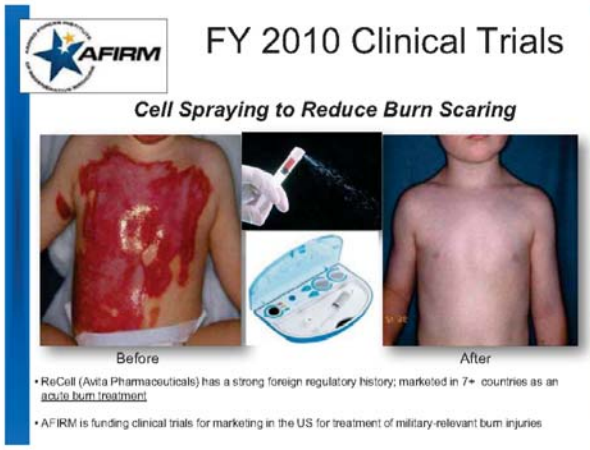

AFIRM
2010 Clinical Trials: Hand Transplantation as a treatment for combat injuries involving hand or forearm loss
Goal: Protocol for treatment of forearm or hand loss by transplantation with local immunomodulation
Status: Enrollment at approved sites is currently underway.

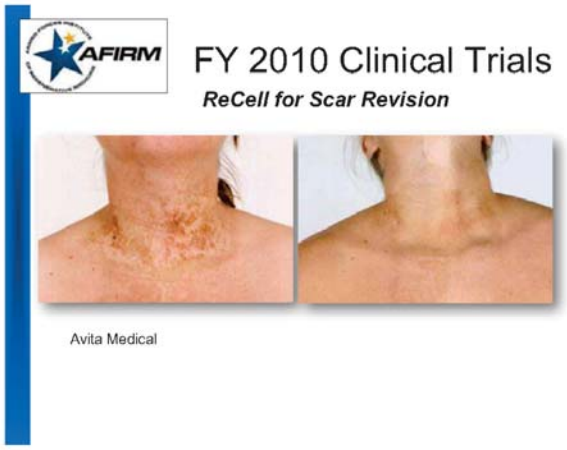

AFIRM
2010 Clinical Trials: Composite Tissue Allograft Transplantation for Face
RCCC has focused on patients with massive facial tissue loss.
The team led by Maria Siemionow, MD Cleveland Clinic Foundation performed the first "face transplant" in the USA.
Recruiting patients for clinical trial; expect additional transplant within the next 6 months. Funding ($2 M) for a total of additional 2 patients.
Future – craniofacial reconstruction and nerve restoration via CTA.
Major advantage: Optimal functional and cosmetic restoration
Major challenge: Immunosuppression therapy

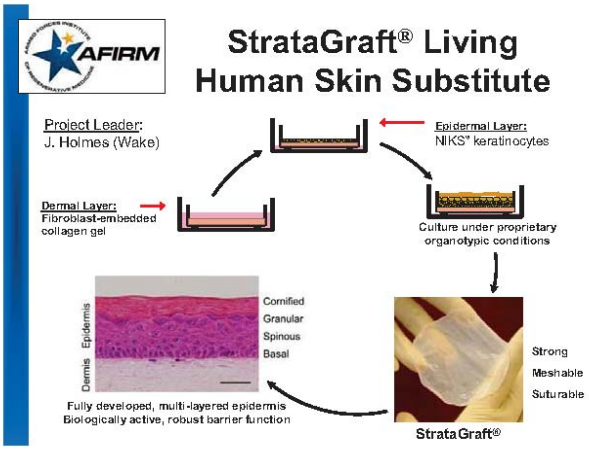

AFIRM
2010 Clinical Trials: Muscle Regrowth Epimorphic Regeneration
CT scan showing 10% increase in quadriceps mass (white arrow) at 4 months post surgery.


AFIRM
FY 2010 Clinical Trials
Fat Injections to Fill Facial Defects
Before
After
A
B
C
D
E
F
Clinical trial uses patient's own fat for filling in dents in the face
Funded by DOD Health Affairs Biotechnology Initiative


AFIRM
FY 2010-2011 Clinical Trials
Year of the Skin
Recell®
Skin Expander
Scarless Wound Healing
StrataGraft®

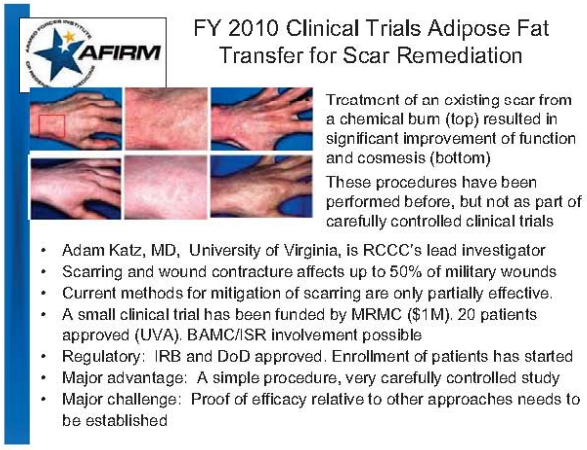

AFIRM
FY 2010 Clinical Trials
Cell Spraying to Reduce Burn Scaring
Before
After
• ReCell (Avita Pharmaceuticals) has a strong foreign regulatory history; marketed in 7+ countries as an acute burn treatment
• AFIRM is funding clinical trials for marketing in the US for treatment of military-relevant burn injuries

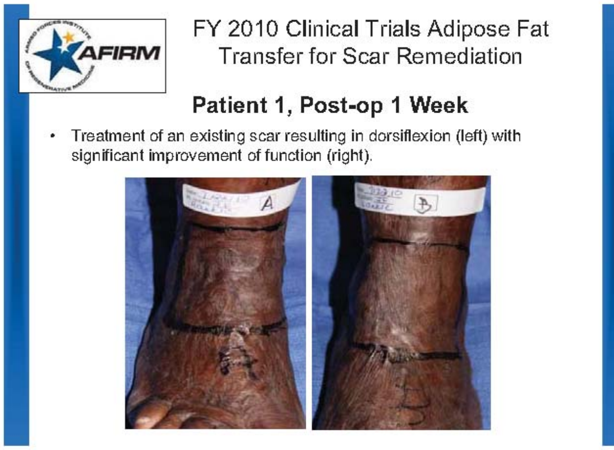

AFIRM
FY 2010 Clinical Trials
ReCell for Scar Revision
Avita Medical


AFIRM
StrataGraft® Living Human Skin Substitute
Project Leader:
J. Holmes (Wake)
Epidermal Layer:
NIKS® keratinocytes
Dermal Layer:
Fibroblast-embedded collagen gel
Culture under proprietary organotypic conditions
Epidermis
Dermis
Cornified
Granular
Spinous
Basal
Strong
Meshable
Suturable
Fully developed, multi-layered epidermis
Biologically active, robust barrier function
StrataGraft®

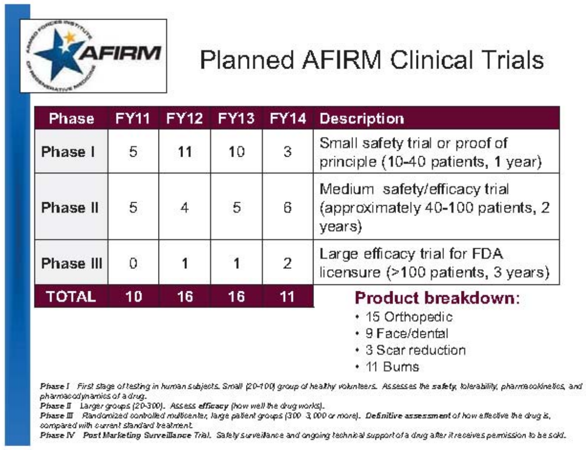

AFIRM
FY 2011 Clinical Trials
Autologous Engineered Skin Substitute for Severe Burns
The AFIRM sponsor (Lonza) is on track to begin enrollment at BAMC in January 2011 following necessary regulatory approvals to conduct the study.


AFIRM
FY 2011 Clinical Trials
Skin Graft Stretching
Meshed Skin graft
160% of surface area is increased

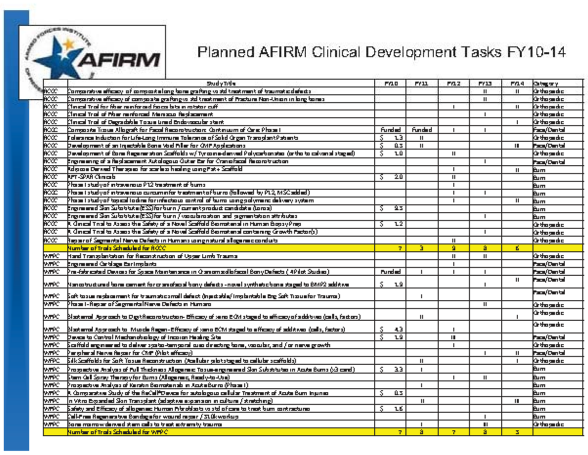

AFIRM
FY 2010 Clinical Trials Adipose Fat Transfer for Scar Remediation
Treatment of an existing scar from a chemical burn (top) resulted in significant improvement of function and cosmesis (bottom)
These procedures have been performed before, but not as part of carefully controlled clinical trials
• Adam Katz, MD, University of Virginia, is RCCC's lead investigator
• Scarring and wound contracture affects up to 50% of military wounds
• Current methods for mitigation of scarring are only partially effective.
• A small clinical trial has been funded by MRMC ($1M). 20 patients approved (UVA). BAMC/ISR involvement possible
• Regulatory: IRB and DoD approved. Enrollment of patients has started
• Major advantage: A simple procedure, very carefully controlled study
• Major challenge: Proof of efficacy relative to other approaches needs to be established



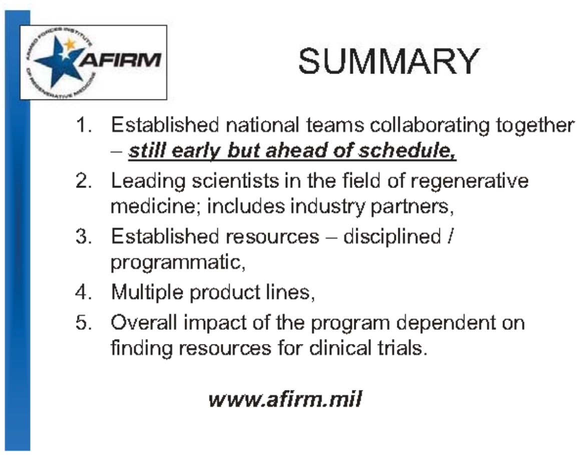
AFIRM
FY 2010 Clinical Trials Adipose Fat Transfer for Scar Remediation
Patient 1, Post-op 1 Week
• Treatment of an existing scar resulting in dorsiflexion (left) with significant improvement of function (right).



AFIRM
Planned AFIRM Clinical Trials
Phase | FY11 | FY12 | FY13 | FY14 | Description
Phase I | 5 | 11 | 10 | 3 | Small safety trial or proof of principle (10-40 patients, 1 year)
Phase II | 5 | 4 | 5 | 6 | Medium safety/efficacy trial (approximately 40-100 patients, 2 years)
Phase III | 0 | 1 | 1 | 2 | Large efficacy trial for FDA licensure (>100 patients, 3 years)
TOTAL | 10 | 16 | 16 | 11
Product breakdown:
• 15 Orthopedic
• 9 Face/dental
• 3 Scar reduction
• 11 Burns
Phase I First stage of testing in human subjects. Small (20-100) group of healthy volunteers. Assesses the safety, tolerability, pharmacokinetics, and pharmacodynamics of a drug.
Phase II Larger groups (20-300). Assess efficacy (how well the drug works).
Phase III Randomized controlled multicenter, large patient groups (300–3,000 or more). Definitive assessment of how effective the drug is, compared with current standard treatment.
Phase IV Post Marketing Surveillance Trial. Safety surveillance and ongoing technical support of a drug after it receives permission to be sold.

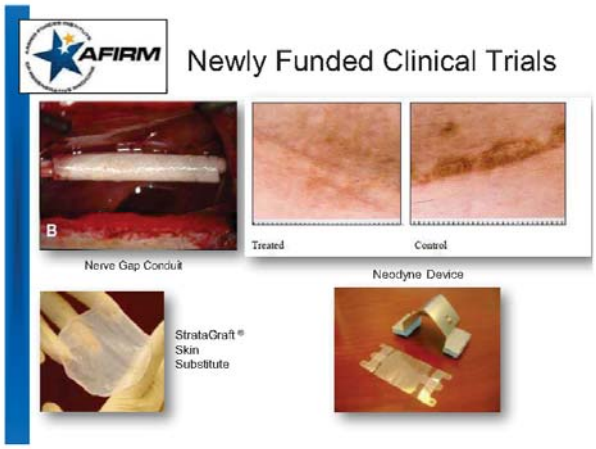


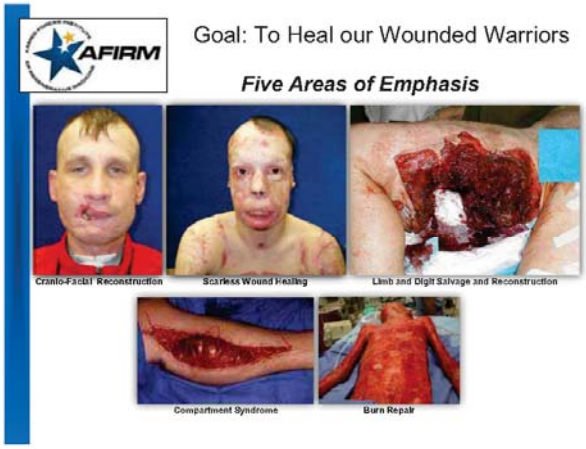
AFIRM
Planned AFIRM Clinical Development Tasks FY10-14



AFIRM
SUMMARY
1. Established national teams collaborating together – still early but ahead of schedule,
2. Leading scientists in the field of regenerative medicine; includes industry partners,
3. Established resources – disciplined / programmatic,
4. Multiple product lines,
5. Overall impact of the program dependent on finding resources for clinical trials.
www.afirm.mil


AFIRM
Backup Slides


AFIRM
Newly Funded Clinical Trials
B
Nerve Gap Conduit
Treated
Control
Neodyne Device
StrataGraft ®
Skin
Substitute


AFIRM
Goal: To Heal our Wounded Warriors
Five Areas of Emphasis
Cranio-Facial Reconstruction
Scarless Wound Healing
Limb and Digit Salvage and Reconstruction
Compartment Syndrome
Burn Repair

Appendix F.

Defense Technical Information Center (DTIC)

Ms. Shari Pitts
DTIC
Information Collection Division


Defense Technical Information Center
Presentation to
AFMS Medical Research Symposium
24 August 2010
Ms. Shari Pitts
Information Collection Division
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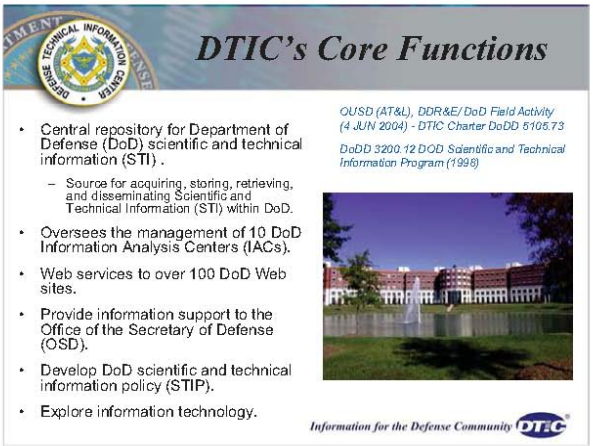
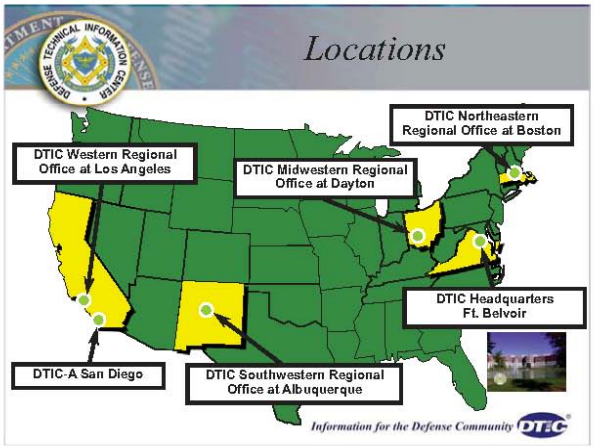
Information for the Defense Community DTIC


DTIC's Mission
To provide essential, technical research, development, testing & evaluation (RDT&E) information rapidly, accurately and reliably to support our DoD customers' needs.
Information for the Defense Community DTIC


DTIC's Core Functions
Central repository for Department of Defense (DoD) scientific and technical information (STI) .
Source for acquiring, storing, retrieving, and disseminating Scientific and Technical Information (STI) within DoD.
Oversees the management of 10 DoD Information Analysis Centers (IACs).
Web services to over 100 DoD Web sites.
Provide information support to the Office of the Secretary of Defense (OSD).
Develop DoD scientific and technical information policy (STIP).
Explore information technology.
OUSD (AT&L), DDR&E/ DoD Field Activity (4 JUN 2004) - DTIC Charter DoDD 5105.73
DoDD 3200.12 DOD Scientific and Technical Information Program (1998)
Information for the Defense Community DTIC


Locations
DTIC Northeastern Regional Office at Boston
DTIC Western Regional Office at Los Angeles
DTIC Midwestern Regional Office at Dayton
DTIC Headquarters Ft. Belvoir
DTIC-A San Diego
DTIC Southwestern Regional Office at Albuquerque
Information for the Defense Community DTIC

What Can DTIC Offer YOU?

Benefits to Customer:

User:

- Facilitate technology transfer and technology transition
- Reduce duplication of effort
- Identify potential sources of funding support
- Locate collaborators, technical support and expertise
- Provides access to medical journal articles for users who can not access Pub Med.

Real advantages...not just regulations

Information for the Defense Community DTIC

What Can DTIC Offer YOU?

Benefits to Customer:

Contributor:

- Contributor has "paperless" archive
- Contributor has cost savings because DTIC:
  - ✓ catalogs and indexes
  - ✓ handles secondary dissemination and authorizes dissemination of restricted documents
  - ✓ ensures secure and long-term storage
- Publication by DTIC makes contributor capabilities and technologies known to appropriate, authorized audiences

Real advantages...not just regulations

Information for the Defense Community DTIC

What Can DTIC Offer YOU?

Public Release Outlets

- **Wide distribution of public release**
  - National Technical Information Service (NTIS) www.ntis.gov
  - Online Computer Library Center (OCLC) www.oclc.org
    Combined catalog of 1 billion unique titles held by 53,548 libraries in 96 countries
  - Open Archiving Initiative (OAI)
    http://www.dtic.mil/dtic/aboutus/current/openarchive.html
    Discoverable by WWW search engines – Google, Monster, Yahoo, etc.
- **Preservation and public access**
  - Library of Congress http://www.loc.gov/rr/scitech/trs/trscollections.html
  - British Library
    http://www.bl.uk/services/document/reportsus.html
  - Canada Institute for Science & Technology
    http://cisti-icist.nrc-cnrc.gc.ca/about/collablist_e.html#docdel

Information for the Defense Community DTIC

DTIC's Primary Collections

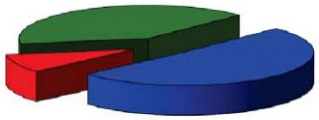
- DTIC Online - *http://stinet.dtic.mil/*
  - No registration; publicly available
  - 924773 public release citations
  - 142271 public release full-text
- DTIC Online Access Controlled
  - Registration; vetted authorization
  - Citations
    - Public release; some full-text
    - Unclassified limited; some full-text
    - Unclassified citations to Secret; no full-text
- STINET on the SIPRNET
  - Registration; vetted authorization

Information for the Defense Community DTIC

DTIC's Primary Collections

- **DTIC's collection contain information that is:**

-Unclassified, Unlimited (U/U) (Available for Public Release)	51%
- Unclassified, Limited /Controlled (U/L) (Unclassified, but sensitive)	40%
- Classified (through Secret)	9%



Information for the Defense Community DTIC

Content Repository

- More than 2 million documents in the Technical Reports collection
- More than 300,000 ongoing and completed DoD Research Summaries
- More than 170,000 descriptions of Independent Research & Development projects

Information for the Defense Community DTIC

Content Repository

Sources of Information

- Defense components
- DoD laboratories
- DoD contractors
- Federally funded R&D centers
- Universities/Military service schools
- SBIR awardees
- Other Federal agencies and their contractors
- Foreign governments
- NATO

Types of Information

- Technical reports
- Test results
- Studies and analyses
- Journal articles
- Proceedings
- Theses and dissertations
- Patent information
- Planning documents
- Command histories
- Research summaries:
  - Ongoing
  - Completed
- Project details:
  - Objective
  - Approach
  - Progress
- Organizational details:
  - Funding data
  - Performing/funding agency/contractor

Information for the Defense Community DTIC

What Can DTIC Offer YOU?

DoDTechipedia Suite of Services

DoDTechipedia Limited (unclassified)

DoDTechipedia Classified

Aristotle Social Networking tool

DEFENSESOLUTIONS.GOV

DefenseSolutions.gov – "Submit a Solution"

Information for the Defense Community DTIC


DoDTechipedia
https://www.dodtechipedia.mil
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General Information
Security and Privacy Notice
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Aristotle
People
Projects
Topics
Two Views:
Graphic Visualization
Modular Visualization
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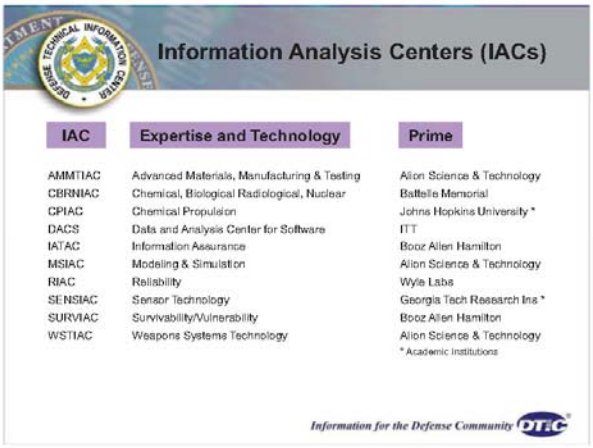
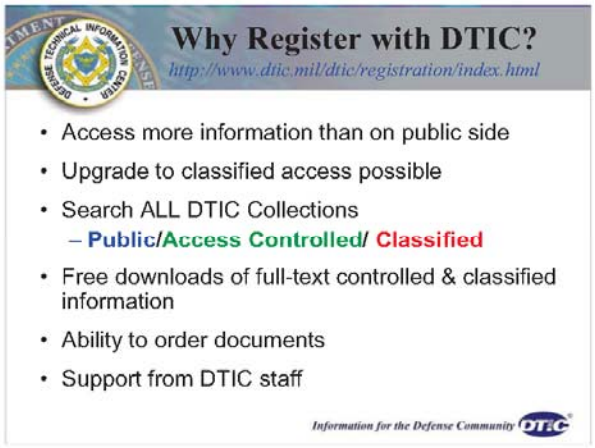
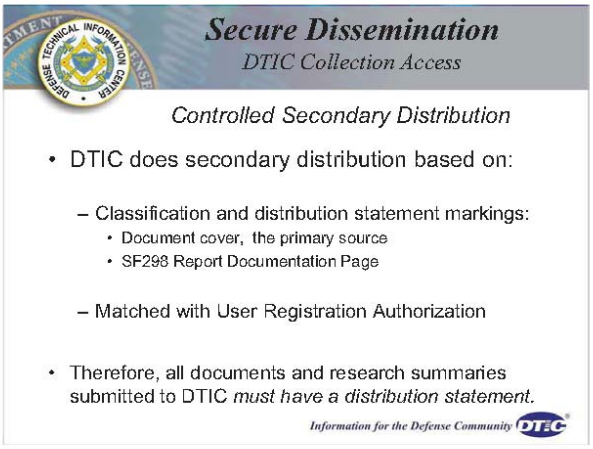
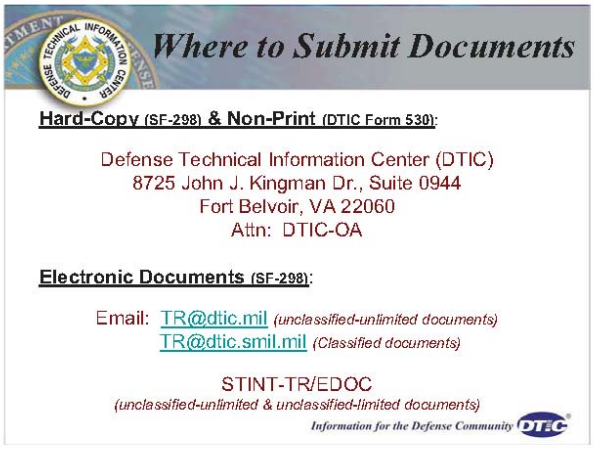

Information Analysis Centers (IACs)
IAC
Expertise and Technology
Prime
AMMTIAC Advanced Materials, Manufacturing & Testing Alion Science & Technology
CBRNIAC Chemical, Biological Radiological, Nuclear Battelle Memorial
CPIAC Chemical Propulsion Johns Hopkins University *
DACS Data and Analysis Center for Software ITT
IATAC Information Assurance Booz Allen Hamilton
MSIAC Modeling & Simulation Alion Science & Technology
RIAC Reliability Wyle Labs
SENSIAC Sensor Technology Georgia Tech Research Ins *
SURVIAC Survivability/Vulnerability Booz Allen Hamilton
WSTIAC Weapons Systems Technology Alion Science & Technology
* Academic Institutions
Information for the Defense Community DTIC


Why Register with DTIC?
http://www.dtic.mil/dtic/registration/index.html
Access more information than on public side
Upgrade to classified access possible
Search ALL DTIC Collections
– Public/Access Controlled/ Classified
Free downloads of full-text controlled & classified information
Ability to order documents
Support from DTIC staff
Information for the Defense Community DTIC


Secure Dissemination
DTIC Collection Access
Controlled Secondary Distribution
• DTIC does secondary distribution based on:
– Classification and distribution statement markings:
• Document cover, the primary source
• SF298 Report Documentation Page
– Matched with User Registration Authorization
• Therefore, all documents and research summaries submitted to DTIC must have a distribution statement.
Information for the Defense Community DTIC


Where to Submit Documents
Hard-Copy (SF-298) & Non-Print (DTIC Form 530):
Defense Technical Information Center (DTIC)
8725 John J. Kingman Dr., Suite 0944
Fort Belvoir, VA 22060
Attn: DTIC-OA
Electronic Documents (SF-298):
Email: TR@dtic.mil (unclassified-unlimited documents)
TR@dtic.smil.mil (Classified documents)
STINT-TR/EDOC
(unclassified-unlimited & unclassified-limited documents)
Information for the Defense Community DTIC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wsmith@dtic.mil
Ms. Shari Pitts
Technical Reports Analyst
(703) 767-8037 DSN 427-8037
spitts@dtic.mil
Information for the Defense Community DTIC

Appendix G.

Blood Pharming

Dr. Stewart Abbot
Celgene Cellular Therapeutics

Blood Pharming:
Novel technologies for large-scale continuous production of human red blood cells

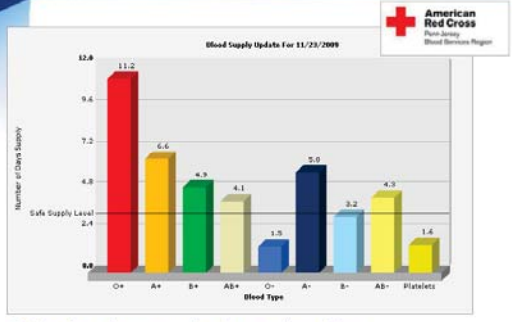
Stewart Abbot
<sabbot@celgene.com>

2010 AFMS Medical Research Symposium

Outline

- **Why**
  - Drive to manufacture Red Blood Cells (RBC) and other Blood Products
- **What**
  - *Ex vivo* recreation of bone marrow "bioreactor"
- **How**
  - Stem cell and bioreactor details
- **When and Where**
  - Therapeutic opportunities

US Blood reserve



Only a few days supply at any given time

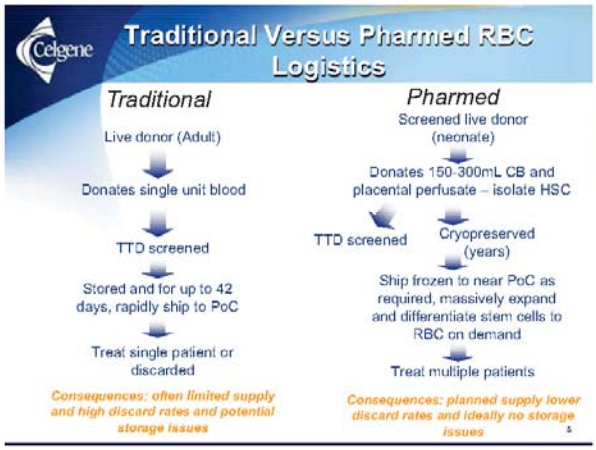
"Blood Pharming"

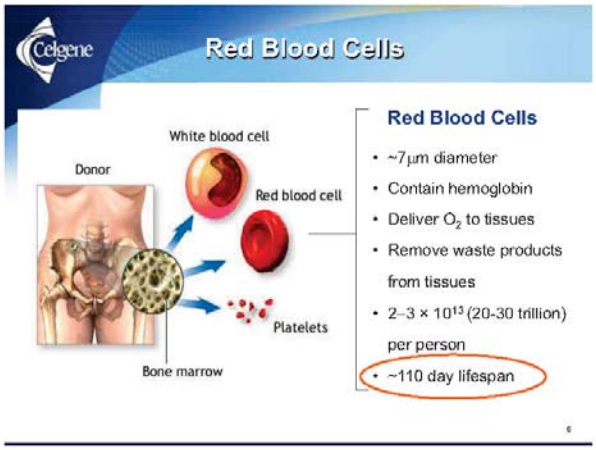
Sponsor

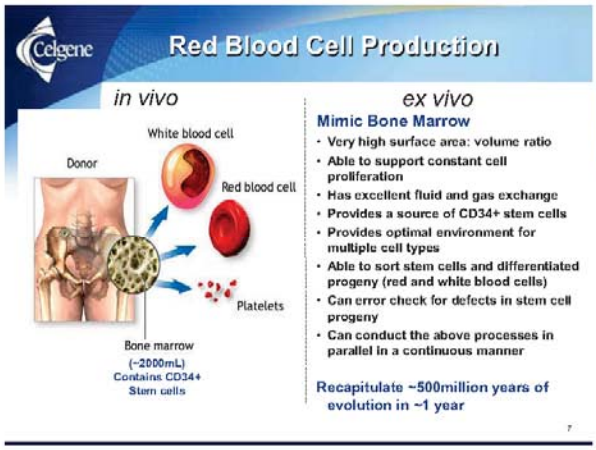
DARPA

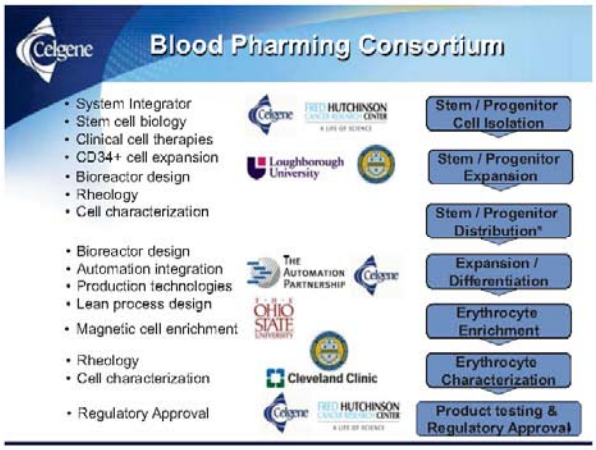
Objective

- Continuous production of Universal Donor RBCs in an automated closed culture system using a non-renewing (replaceable) progenitor cell population for treatment of battlefield trauma


Traditional Versus Pharmed RBC Logistics
Traditional
Live donor (Adult)
Donates single unit blood
TTD screened
Stored and for up to 42 days, rapidly ship to PoC
Treat single patient or discarded
Consequences: often limited supply and high discard rates and potential storage issues
Pharmed
Screened live donor (neonate)
Donates 150-300mL CB and placental perfusate – isolate HSC
TTD screened
Cryopreserved (years)
Ship frozen to near PoC as required, massively expand and differentiate stem cells to RBC on demand
Treat multiple patients
Consequences: planned supply lower discard rates and ideally no storage issues


Red Blood Cells
White blood cell
Donor
Red blood cell
Platelets
Bone marrow
Red Blood Cells
~7μm diameter
Contain hemoglobin
Deliver O_2 to tissues
Remove waste products from tissues
$2–3 \times 10^{13}$ (20-30 trillion) per person
~110 day lifespan


Red Blood Cell Production
in vivo
White blood cell
Donor
Red blood cell
Platelets
Bone marrow
(~2000mL)
Contains CD34+
Stem cells
ex vivo
Mimic Bone Marrow
Very high surface area: volume ratio
Able to support constant cell proliferation
Has excellent fluid and gas exchange
Provides a source of CD34+ stem cells
Provides optimal environment for multiple cell types
Able to sort stem cells and differentiated progeny (red and white blood cells)
Can error check for defects in stem cell progeny
Can conduct the above processes in parallel in a continuous manner
Recapitulate ~500million years of evolution in ~1 year


Blood Pharming Consortium
System Integrator
Stem cell biology
Clinical cell therapies
CD34+ cell expansion
Bioreactor design
Rheology
Cell characterization
Bioreactor design
Automation integration
Production technologies
Lean process design
Magnetic cell enrichment
Rheology
Cell characterization
Regulatory Approval
Cleveland Clinic
Stem / Progenitor Cell Isolation
Stem / Progenitor Expansion
Stem / Progenitor Distribution*
Expansion / Differentiation
Erythrocyte Enrichment
Erythrocyte Characterization
Product testing & Regulatory Approval

Recapitulating Bone Marrow

Ex vivo generation of fully mature human red blood cells from hematopoietic stem cells

Marie-Catherine Giarratana[1], Ladan Kobari[1], Hélène Lapillonne[1,2], David Chalmers[1,3], Laurent Kiger[4], Therese Cynober[5], Michael C Marden[4], Henri Wajcman[6] & Luc Douay[1,2]

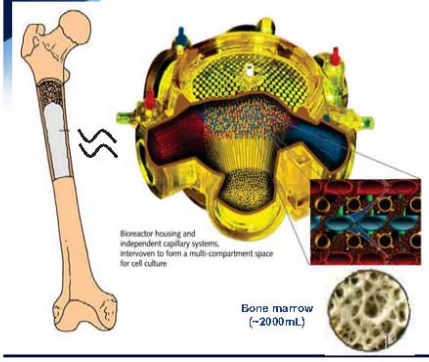
NATURE BIOTECHNOLOGY VOLUME 23 NUMBER 1 JANUARY 2005

Typical "flask" culture
- ~1E6 cells/mL
- Require 2000L to generate 2E12 RBC

Typical "stirred tank" culture
- ~1E7 cells/mL
- Require 200L to generate 2E12 RBC

Typical "hollow fiber" culture
- ~1E7 cells/mL
- Require 200L to generate 2E12 RBC

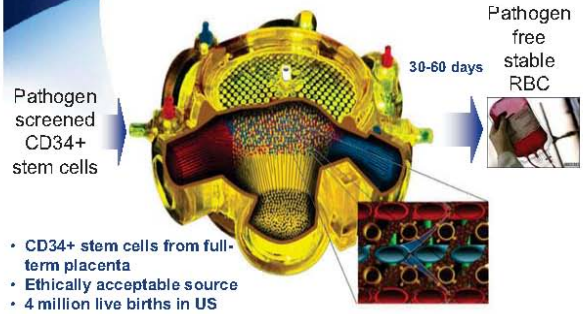
Recapitulating Bone Marrow Novel Bioreactors



- Hollow fiber based device contains two different fiber types for oxygen/media delivery and waste removal
- Interwoven fibers form separate cell compartment for decentralized mass exchange
- ~2-8E8 cells/mL
- Require 4-10L to generate 2E12 RBC

10

Bioreactor system



- CD34+ stem cells from full-term placenta
- Ethically acceptable source
- 4 million live births in US
- Screened for TTD before and tested after birth

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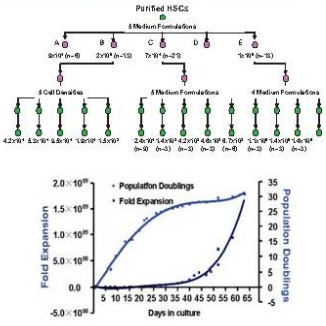
Expansion & Differentiation Optimization

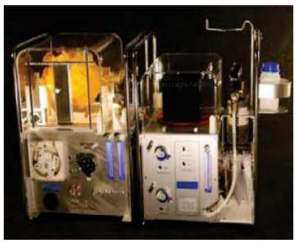
- Media Optimization
  - >100 media combinations assessed
  - Screening DOE approach
  - Numerous small scale extrapolated to few large scale expts.
  - Current best ~2E9 CD34+ fold expansion with over 80% RBC-like cells
    - Literature best ~2E6



12

Compact High Efficiency Bioreactor Module

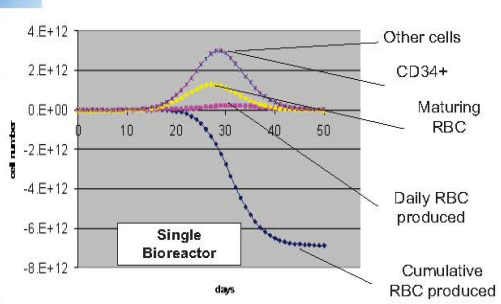
- Modular small-footprint bioreactor
- Perfusion fluidics facilitate on the fly cell addition and harvest
- Perfusion fluidics facilitate integration of process analytics
- Reactor design supports sustained culture >2x10^8 cells/mL (partially optimized)
- Reactor design supports enhanced maturation cf. conventional culture
- Linked reactors ensue system redundancy and continuous production



Compact Unit (~36feet^3)

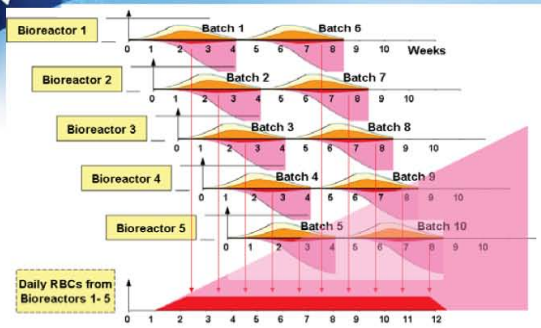
13

Large-Scale Bioreactor Growth



14

Continuous Production System

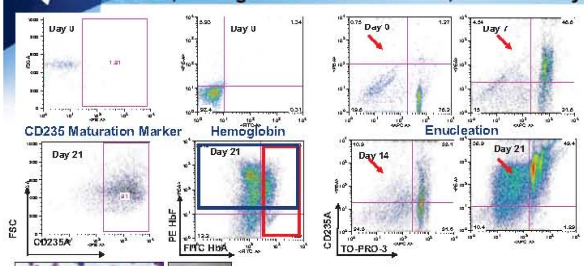


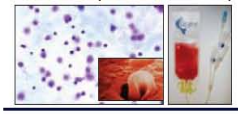
Targeting 50 units/week (~1E14 cells) capacity

15

RBC Characterization

CD235, hemoglobin and enucleation, deformability

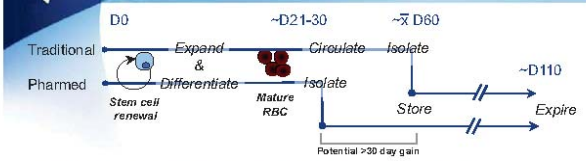




Stem cell derived "pharmed" red blood cells look and behave like donated red blood cells

16

Unique Product Attributes



- Product isolated early in lifespan = ↑ storage or ↓ storage lesions
- Potential ↑ storage time = ↓ waste
- Highly screened feedstock populations = ↓ TTD
- Readily obtainable feedstock population = enhanced logistics
- Cryopreservable feedstock population = procurement decoupled from use
- Highly expandable feedstock = enhanced logistics (shipping few units stem cells versus 100-1000s units RBC)
- Few donors → multiple doses = select & expand rare blood types
- *Ex vivo* expansion and enucleation = opportunity for safe genetic modification

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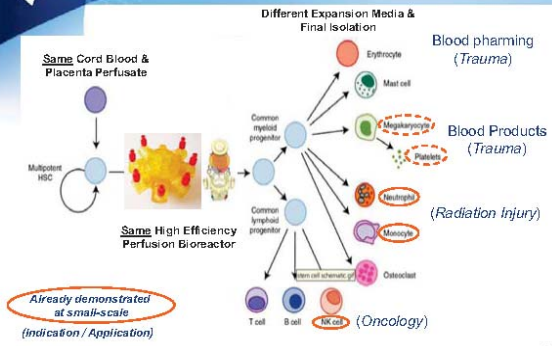
Platform Opportunities



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Phase 1 Lessons and Phase 2 Goals

- **Lessons**
  - **Proof of concept achieved**
    - **demonstrated continuous production of immature RBCs on a 2mL and 8mL scale.**
  - **Developed solutions to all key technical hurdles**
  - **Relatively high proportions of reticulocytes (slightly immature RBC) in final product**
  - **Perfusion bioreactor scale to be increased 100x**
  - **Magnetic separation system throughput to be increased 100x**
  - **Media and mitogen / cytokine costs are prohibitive**
- **Goals**
  - **Refine system to enable robust clinical-scale and clinical-grade product**
  - **Optimize system to decrease COGS by >100x**
  - **Enhance terminal maturation (reticulocyte → erythrocyte)**

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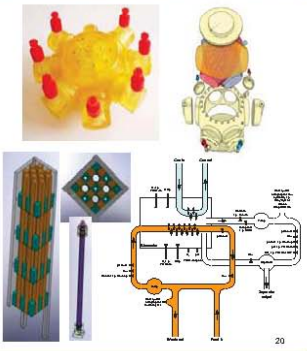
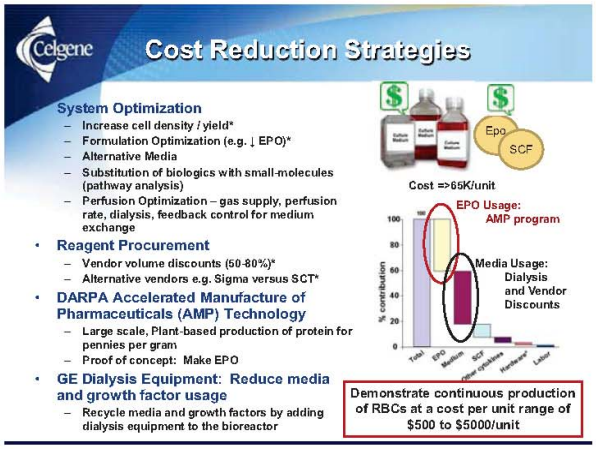
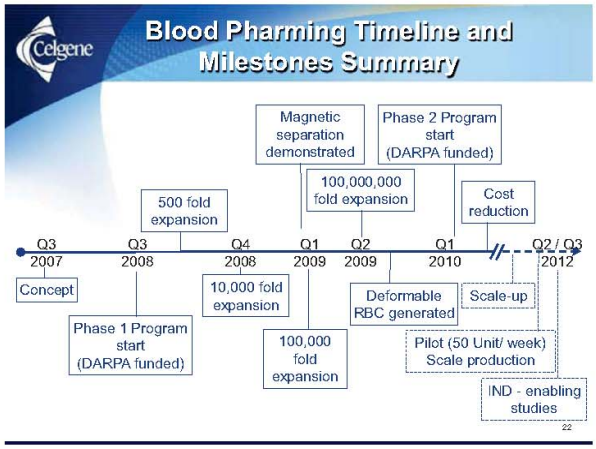
Scale-up and Scale-out

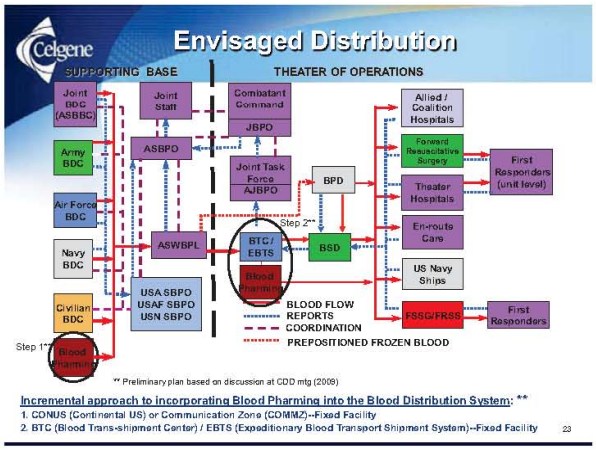
- Basic perfusion system fluidics can be scaled to 10,000mL
- Basic bioreactor design can be scaled from 8mL → 800mL without loss of performance
- Perfusion bioreactor optimization to include enhanced PAT
- Perfusion bioreactors operating on 3 sites at 800mL scale by Q4
- Produced 6 new perfusion systems and 60+ bioreactors in last month
- 100x increase in magnetic sorting throughput by incorporating 2x2 array of longer flow cells



20


Celgene
Cost Reduction Strategies
System Optimization
– Increase cell density / yield*
– Formulation Optimization (e.g. ↓ EPO)*
– Alternative Media
– Substitution of biologics with small-molecules (pathway analysis)
– Perfusion Optimization – gas supply, perfusion rate, dialysis, feedback control for medium exchange
• Reagent Procurement
– Vendor volume discounts (50-80%)*
– Alternative vendors e.g. Sigma versus SCT*
• DARPA Accelerated Manufacture of Pharmaceuticals (AMP) Technology
– Large scale, Plant-based production of protein for pennies per gram
– Proof of concept: Make EPO
• GE Dialysis Equipment: Reduce media and growth factor usage
– Recycle media and growth factors by adding dialysis equipment to the bioreactor
Epo
SCF
Cost =>65K/unit
EPO Usage: AMP program
Media Usage: Dialysis and Vendor Discounts
% contribution
Demonstrate continuous production of RBCs at a cost per unit range of $500 to $5000/unit


Celgene
Blood Pharming Timeline and Milestones Summary
Magnetic separation demonstrated
Phase 2 Program start (DARPA funded)
100,000,000 fold expansion
Cost reduction
500 fold expansion
Q3 2007
Q3 2008
Q4 2008
Q1 2009
Q2 2009
Q1 2010
Q2 / Q3 2012
Concept
Phase 1 Program start (DARPA funded)
10,000 fold expansion
100,000 fold expansion
Deformable RBC generated
Scale-up
Pilot (50 Unit/ week) Scale production
IND - enabling studies
22


Celgene
Envisaged Distribution
SUPPORTING BASE
THEATER OF OPERATIONS
Joint BDC (ASBBC)
Army BDC
Air Force BDC
Navy BDC
Civilian BDC
Joint Staff
ASBPD
ASWBPL
USA SBPO
USAF SBPO
USN SBPO
Combatant Command
JBPO
Joint Task Force AJBPO
BTC / EBTS
Blood Pharming
BPD
BSD
Allied / Coalition Hospitals
Forward Resuscitative Surgery
Theater Hospitals
En-route Care
US Navy Ships
FSSG/FRSS
First Responders (unit level)
First Responders
Step 2**
Step 1**
BLOOD FLOW
REPORTS
COORDINATION
PREPOSITIONED FROZEN BLOOD
** Preliminary plan based on discussion at CDD mtg (2009)
Incremental approach to incorporating Blood Pharming into the Blood Distribution System: **
1. CONUS (Continental US) or Communication Zone (COMMZ)--Fixed Facility
2. BTC (Blood Trans-shipment Center) / EBTS (Expeditionary Blood Transport Shipment System)--Fixed Facility
23


Celgene
Acknowledgements
THE AUTOMATION PARTNERSHIP
FRED HUTCHINSON CANCER RESEARCH CENTER
A LIFE OF SCIENCE
Loughborough University
DSO
THE OHIO STATE UNIVERSITY
BRIDGING THE GAP
DARPA
POWERED BY IDEAS
Cleveland Clinic
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Appendix H.

Mild Traumatic Brain Injury and Sleep

Dr. Michael Russo
Traumatic Brain Injury Neurologist

Air Force Medical Research Symposium - 26 August 2010

Sleep, Wake, and Traumatic Brain Injury

COL (R) Michael B Russo, MD, FS, FAASM, FACP, FAAN, FAsMA
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Associate Clinical Professor of Medicine
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1

Conflict of Interest Disclosure:

I do not have any conflicts of interest.

2

Traumatic Brain Injury (TBI) brief overview

- **Other Terms:** Acquired brain injury, Head injury, Mechanical brain injury, Concussion
- **Cause:** Sudden trauma results in damage to the brain.
- **Types:**
  - May be "Closed" or "Open"
  - May be Severe, Moderate, Mild – no universally agreed upon definition

Mild:
- *Closed head*
- *At moment of Injury:* +/- Loss of Consciousness. If + LOC, brief, few seconds or minutes.
- *Following injury:* + Headache; +/- confusion, lightheadedness, dizziness, blurred vision or tired eyes, ringing in the ears, bad taste in the mouth, fatigue, sleepiness or lethargy, a change in sleep patterns, behavioral or mood changes, and trouble with memory, concentration, attention, or thinking.

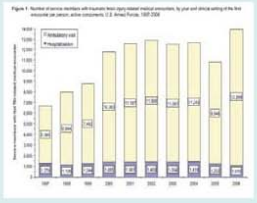
Moderate or Severe:
- *May be open or closed*
- *At moment of Injury:* Usually LOC , but not always.
- *Following Injury:* Headache that gets worse or does not go away, + neuroimaging changes. +/- repeated vomiting or nausea, convulsions or seizures. +/- inability to awaken from sleep, neuro findings to include dilation of one or both pupils, slurred speech, weakness or numbness in one or more extremities, loss of coordination, and increased confusion, restlessness, or agitation.

3

Epidemiology

ICD-9 Codes for Skull Fracture; Intracranial Injury; Head Injury, unspecified

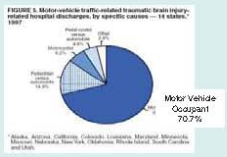
Armed Forces: 1997-2006
110,392 new-patient visits/hospitalizations



Medical Surveillance Monthly Report, - Armed Forces Health Surveillance Center - Vol 14, No 5, Sept 2007: pg 3

Civilian sector - 2006
1.4 million significant TBI *annually*

- 50,000 die;
- 235,000 are hospitalized;
- 1.1 million treat release.

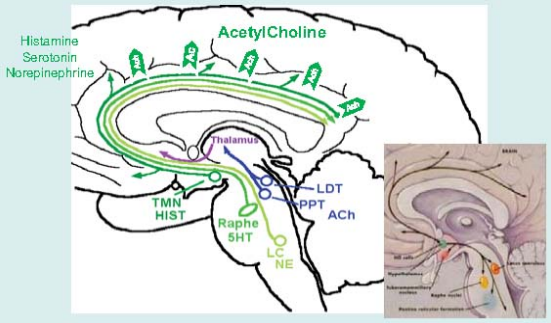


Langlois JA, Rutland-Brown W, Thomas KE. *Traumatic Brain Injury in the United States: Emergency Department Visits, Hospitalizations, and Deaths. Atlanta (GA): Centers for Disease Control and Prevention, National Center for Injury Prevention and Control; 2006.*

4

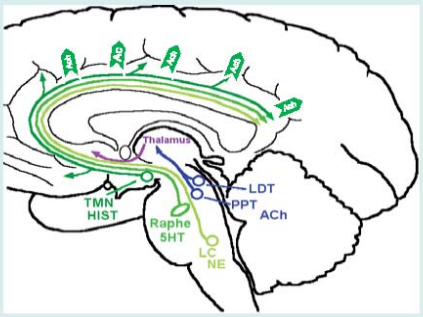
WAKE REQUIRES FUNCTIONAL NETWORK THROUGH BRAIN

Monoaminergic – AcetylCholinergic Ascending Arousal System



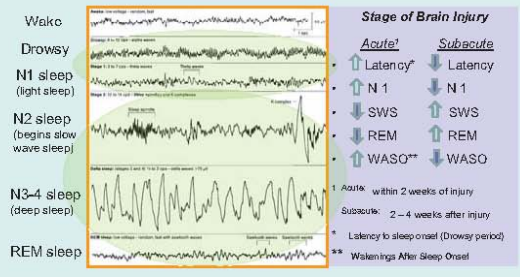
After Trauma

Neurotransmitter pathways desynchronize and fail to maintain wake



6

Polysomnographic changes after brain injury



Stage of Brain Injury

	Acute[1]	*Subacute*
•	⇧ Latency*	⇩ Latency
•	⇧ N 1	⇩ N 1
•	⇩ SWS	⇧ SWS
•	⇩ REM	⇧ REM
•	⇧ WASO**	⇩ WASO

1 Acute: within 2 weeks of injury
Subacute: 2 – 4 weeks after injury
* Latency to sleep onset (Drowsy period)
** Wakenings After Sleep Onset

• George B et al. Night Sleep Disorders during recovery of severe head injuries. Neurochirurgie 1981;27:35-38
• Ron S et al. Time related changes in the distribution of sleep stages in brain injured patients. Electroencephalography and clinical neurophysiology. 1980; 48: 432-441

7

TBI – Sleep
Cases and Discussion

The Football Player
The Boxer
The Blast

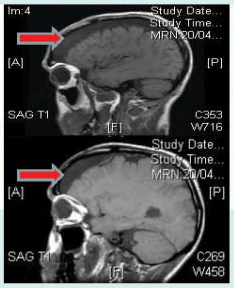
8

Glascow Coma Scale and Neuroimaging do not necessarily reflect severity of injury

MRI:
Massive bilateral subdural hygromas

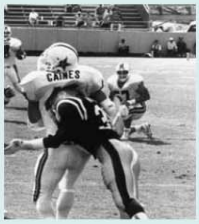
most likely began as slow-developing subdural hematomas after 1985 injury

Causing an irreversible acquired sclerosis of primary motor regions



Football Injury

- **39 y/o active duty soldier** referred for intractable headaches.
- Constant H/A after most recent injury when **used head as battering ram** during football game.
- Brief LOC, Not hospitalized.
- 6 concussions over 10 years, 3 w/ brief LOC.
- Denies memory/concentration impairments.
- Admits neck pain and occasional tingling hands
- ONLY WHEN ASKED: C/o of difficulty sleeping for one year.



"**Spearing**" or "**Head-down contact**" may result in both *brain* and *spinal column* injury.

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Case: Football Injury

Headaches: 5 yr Hx, right hemicranial stabbing pain, radiating into posterior neck; mod to severe intensity.
- All day, every day since recent injury.
- Denies: n/v, photo/phonophobia, exercise intolerance.
- Denies: improvement with Imitrex or Excedrin.

Sleep:
- *Difficulty falling asleep*
- *"Mind races."*
- *Snores* loudly awakening himself. *Thrashes and jumps.*
- *Sleepy and fatigued daily.*
- *Naps* once or twice per day.

Neurological exam: Non-focal.
Brain CT: Normal

Differential Diagnosis:
- *Headaches:* primary vs. secondary? Atypical migraine, neuralgia, musc-skel, cervical spine?
- *Insomnia* – psychophysiological?
- *Obstructive Sleep Apnea*?
- *REM Sleep behavioral disorder, periodic limb movements, restless legs, seizures?*
- *Hypersomnia*, sleep deprivation, post-traumatic narcolepsy, post-traumatic encephalopathy?

TBI Type? - based upon available info:
+ LOC (brief)
GCS - unknown
Hospitalization - none
Neuro exam – Normal
CT brain - Normal

.....mild TBI?

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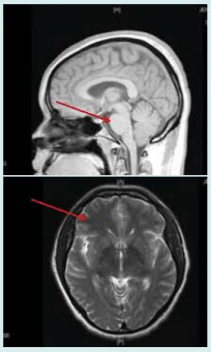
Case: Football Injury

- **MRI Imaging:** shows white matter lesions in paramedian pons and right frontal regions.
- **Overnight Polysomnography:** AHI " 34 w/ desats to 88%.
- **MSLT** shows sleep onset latency of 6 min. No Sleep-onset REMs

Diagnoses:
1. moderate TBI,
2. Post-traumatic Obstructive Sleep Apnea.
3. Sleep Deprivation-related daytime sleepiness
4. Insomnia: TBI-related psychophysiologic-type at sleep-onset

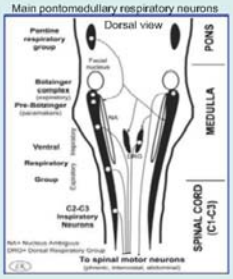
• *Apnea Hypopnea Index.* Number of breathing interruptions per hour.
OSA: Mild 5-15. Mod 16-30. Severe >30/hr



Brainstem lesions may interrupt respiratory nuclear groups in

Post-traumatic Sleep Apnea

Main pontomedullary respiratory neurons



Pons: Respiratory-modulated cells signal the medullary rhythm and pattern generator cells.

Medulla (upper): Botzinger cell groups pace respiration and signal descending inspiratory and expiratory pathways.

Medulla (lower): Major respiratory pump muscles nuclear clusters control diaphragm and intercostals.

These brainstem respiratory nuclear groups form a network that ensures reciprocal activation and inhibition of the respiratory cycle muscles.

Markland ON, Dyken ML. Sleep abnormalities in patients with brainstem lesions. Neurology. 1976;26:769-776.
Duffin J. Functional organization of respiratory neurones: a brief review of current questions and speculations. Exp Physiol 2004;89:517-529.
Ezure K. Reflections on respiratory rhythm generation. Progr Brain Res 2004;143:67-74.
Slide modified from Leszek Kubin, PhD

Treatment Pearls

On-the-field trepanation:
Remove the helmet first !

Prevention is the best treatment
Benchwarmers have fewest injuries

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Trepanation

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Case Discussion: The Boxer

19 y/o boxer c/o inability to sleep for 6 months.

- frequent awakenings, vivid dreams.
- Naps at work and before dinner.
- 5 concussions, several with LOC.

Neuro exam positive: Nystagmus; Hyperreflexic Hoffman's; Clonus; Tremor

CT brain normal

Differential Dx:

TBI: - mild vs moderate?

- **Motor systems damage**
  - **Corticospinal tracts, basal ganglia? (Hyperreflexia and tremor)**
- **Wake / Sleep systems damage**
  - **Hypothalamus and basal forebrain? (Sleepiness)**
  - **Brainstem, midbrain, and pontine damage: medial longitudinal fasciculus and ascending reticular activating systems (nystagmus)?**

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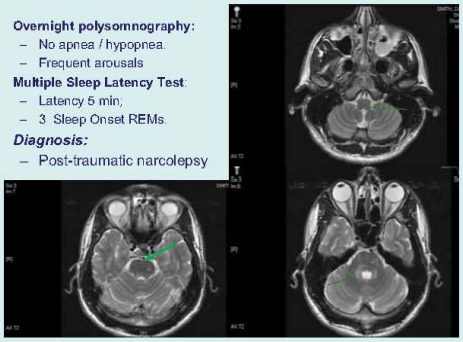
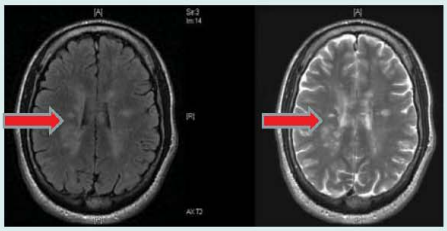
The Boxer - work-up

- **Overnight polysomnography:**
  - No apnea / hypopnea.
  - Frequent arousals
- **Multiple Sleep Latency Test**:
  - Latency 5 min;
  - 3 Sleep Onset REMs.
- ***Diagnosis:***
  - Post-traumatic narcolepsy



Boxer's MRI mimics Multiple Sclerosis
but w/u for MS negative



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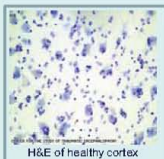
Some pharmacologic treatments for post-traumatic narcolepsy

- **Sodium oxybate (Xyrem)** Rapid induction of deep sleep. Used to maintain sleep because in narcolepsy, sleep is very disrupted. Short half-life. 6-9gms/night. Start with 4.5gms divided into two doses: one at bedtime, one 4 hours later. (Schedule III – moderate abuse potential. Decreases cataplexy.
- **Modafinil (Provigil)** - 100 or 200mg upon awakening. Novel drug with minimal physiological side effects. Effective about 4-6 hours. (Schedule IV – low abuse potential).
- **Armodafinil (Nuvigil)** – 150 or 250mg upon awakening. R-enantiomer of modafinil. Effective 8-10 hours. (Schedule IV – low abuse potential)
- **Dextroamphetamine (Dexadrine)** – 10 or 20mg upon awakening, physiological manifestations, effective 8-10 hours or longer. (Schedule II – high abuse potential) Tolerance, withdrawal.


Pharmacotherapy of Excessive Sleepiness: Focus on Armodafinil

19

Dementia Pugilistica
pathology similar to Alzheimer's


H&E of healthy cortex


Chronic Traumatic Encephalopathy, neurofibrillary tangles

Quarry dead at 53: "last fight of his life"
SportsLine wire reports
Jan. 3, 1999

TEMPLETON, Calif. – Jerry Quarry, a popular heavyweight who fought Muhammad Ali and Floyd Patterson then eventually ***lapsed into a punch-drunk fog,*** died Sunday after being taken off life support. He was 53.

By the age of 50, the pounding he had taken in the ring turned him into a ***confused, childlike man whose relatives had to take care of him.***

THE MEDICAL NAME FOR his condition was ***dementia pugilistica***, severe brain damage caused by repeated blows to the head.

Neurological tests revealed early signs of dementia in 1982, before his short-term memory loss and motor skills deteriorated so noticeably and before his last three fights.

Treatments of Dementia Pugilistica

- Cognitive disorder: rivastigmine (Exelon), donezapil (Aricept), galantamine (Razadyne).
  - AcetylCholinesterase Inhibitors increase available acetylcholine to neurons and glia. Hypothesis that this triggers neuronal-glial healing.


Central acetylcholinesterase inhibitors in the treatment of chronic traumatic brain injury—clinical experience in 111 patients

Olli Tenovuo*

61% marked improvement, 39% mild to no improvement

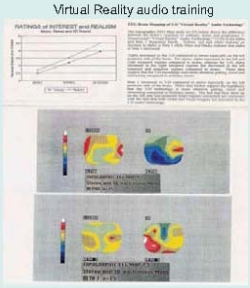
Olli Tenovuo
Progress In Neuropsychopharmacology and Biological Psychiatry
29; 2005: 61-67

21

Novel Non-pharmacological treatments for TBI-Related Insomnia

- Often resistant to conventional therapies.
- **Sleep hygiene, CBT,** monotherapy…..
  - Virtual Reality (three-D) Audio Sleep Training
  - starts loud and exciting, then slowly winds down over 30 minutes.
    - JACKSON TB, ALSTEN C Replacement of sedative-hypnotics with a multi-modality, tape recorded insomnia treatment program on a locked psychiatric unit Sleep Research 1995, 24:399.
    - ALSTEN C, DOWNEY R 3D, JACKSON TB Preliminary evaluation of a "sleep training" program to enhance the quality and quantity of slow-wave sleep, Sleep Research 1995, 24: 65

Virtual Reality audio training



22

Monotherapy vs. polypharmacy

Pharmacokinetic Properties and Dosages of Some Hypnotic Drugs Used in the Treatment of Insomnia
(Modified from Table 36-1, Kryger, Roth, Dement, Principles and Practice of Sleep Medicine, 4th Edition, On-line, Reproduced with permission of Elsevier.)

Hypnotic Drugs*	Half-life (hr)	Onset of Action (min)†	Pharmacologically Active Metabolites	Dose (mg)
Benzodiazepine hypnotics				
Flurazepam (Dalmane)	48-120	15-45	N-desalkyl (flurazepam)	15-30
Triazolam (Halcion)	2-6	2-30	None	0.125-0.25
Estazolam (ProSom)	8-24	Intermediate	None	1-2
Temazepam ‡ (Restoril)	8-20	45-60	None	15-30
Lorazolam# (Dormicum)	4.6-11.4	-	None	1-2
Flunitrazepam# (Rohypnol)	10.7-20.3	Short	N-desmethyl (flunitrazepam)	0.5-1
Lormetazepam# (Loramet)	7.5-11.4	-	None	1-2
Nitrazepam# (Mogadon)	25-35	Intermediate	None	5-10
Nonbenzodiazepine hypnotics				
Eszopiclone (Lunesta)	5-6	Rapid	N-desmethyl zopiclone	2-3 adult, 1-2 elderly
Eszopiclone (Estorra)**	5-7	Intermediate	None	2-3 adult, 1 elderly
Zolpidem (Ambien)	1.5-2.4	Rapid	None	5-10 (age <65 yr)
Zolpidem# (Imovane)	5-6	Intermediate	None	3.75 (age >65 yr)
				7.5 (age <65 yr)
Zaleplon (Sonata)	1	Rapid	None	5-10

Polypharmacy
- start with trazodone (50 or 100mg) in early evening to induce sleepiness, then at bedtime….
- zolpidem (Ambien) 10mg, or
- ezopiclone (Lunesta) 3mg, or
- zaleplon (Sonata) 10mg.

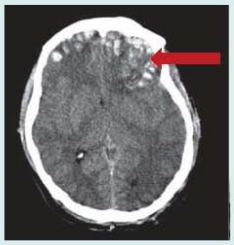
- If sleep maintenance is a problem, temezepam (Restoril) 30mg or
- zolpidem extended release (Ambien CR) 12.5mg.

23

Case: The Blast

- **39 y/o soldier exposed to IED blast…**
  - LOC for undetermined period.
  - Seizure after the injury, none since. Not taking any antiepileptic medications.
- **Sleepy** during days, often naps.
  - Inability to fall asleep, awakenings during night.
  - Denies snoring.
- **Headaches**
  - …began after exposure to IED blast
- Unmarried, lives alone.
- **Mental Status exam** alert, oriented, normal memory, somewhat disinhibited.
- **Neuro exam:** antigravity tremor ; brisk reflexes throughout.

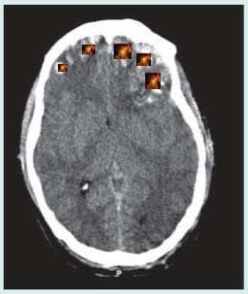
Brain CT after injury showed:



24

Case: The Blast

- **Overnight Polysomnography**
  - No hypopnea
  - No apnea.
- **Multiple Sleep Latency Test**
  - Sleep onset latency 6 min.
  - No Sleep Onset REMs
- **EEG**
  - Normal
- **72 hour EEG monitoring:**
  - Epileptogenic foci left and right frontal regions
  - Seizures arose during transition from N1 to N2 sleep.
  - *Patient unaware of seizures.*



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Sleep Seizures in TBI

- Seizures during sleep most frequently arise from Non-REM, specifically stage N2. Partial seizures arise from epileptogenic foci in irritated brain.

Courtesy of Alon Avidan, Residency Director, UCLA Department of Neurology

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Sleep Seizures in TBI

- Brief partial seizures may go unnoticed and be a cause of fragmented sleep and daytime sleepiness.

Courtesy of Alon Avidan

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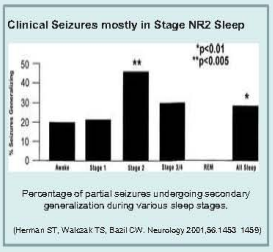
Post-Traumatic Seizures during Sleep



Percentage of partial seizures undergoing secondary generalization during various sleep stages.

(Herman ST, Walczak TS, Bazil CW. Neurology 2001;56:1453 1459)

Nocturnal seizures most common in Sleep Stage N2

- 57% of TBI patients developing Post-Traumatic Epilepsy have 1st Sz within 1 yr of injury
- If seizures occur within the first week after injury (an early seizure), then an increase in the incidence of late epilepsy has been observed.

- Caveness WF. Epilepsy, a product of trauma in our time. Epilepsia. 1976;17:207 215
- Rapport RL, Penry JK. Pharmacologic prophylaxis of post traumatic epilepsy: a review. Epilepsia. 1972;13:295 304
- Salazar AM, Jabbari B, Vance SC, et al. Epilepsy after penetrating head injury. I. Clinical correlates: a report of the Vietnam Head Injury Study. Neurology. 1985;35:1406 14
- Jennett B. Early traumatic epilepsy. Incidence and significance after non missile injuries. Arch Neurol. 1974;30:394 398).
- Jennett WB, Lewin W. Traumatic epilepsy after closed head injuries. J Neurol Neurosurg Psychiatry. 1960;23:295 301)

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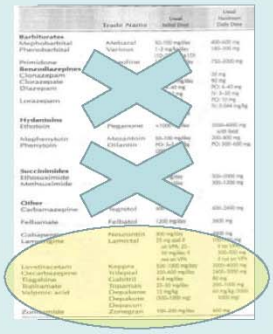
Pharmacological Treatments for Partial Onset Seizures

29

Anticonvulsants in TBI



- New AEDs have fewer side effects.
- Tiagabine, topiramate, levetiracetam, oxcarbazepine, lamotrigine, have good efficacy.
- Tiagabine, gabapentin, pregabalin have positive effects on sleep.

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AED Effects on Sleep Architecture and Complaints

Drug	Sleep efficiency	Total sleep time	Sleep latency	Arousals	Stage 1	Stage 2	Stage 3/4	REM sleep	Sleep complaints/ disorder effects
Phenytoin	Decrease	None	Decrease	Decrease	Increase	Increase	Decrease	None	Sleepiness
Carbamazapine	Increase	None	Decrease	Decrease	None	None	Increase	Transient decrease	Sleepiness; treats RLS
Phenobarbital	Decrease	None	Decrease	Decrease	Increase	Increase	None	Decrease	Sleepiness; OSA
Ethosuximide	Decrease	Unknown	Unknown	Increase	Increase	None	Decrease	Increase	Unknown
Valproate	None	None	None	Increase	Unclear	None	Increase	Mild decrease	Sleepiness; OSA
Felbamate	Decrease	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Insomnia
Lamotrigine	None	None	None	None	None	None	Unclear	Mild increase	(rare)
Gabapentin	Increase	Increase	Decrease	Decrease	Decrease	None	Increase	Increase	Treats RLS
Topiramate	None	None	None	None	None	None	None	None	Unknown
Vigabatrin	Unknown	None	None	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown
Tiagabine	Increase	None	None	None	None	None	Increase	None	Unknown
Levetiracetam	None	None	None	None	None	Increase	Decrease	None	Insomnia (rare)
Zonisamide	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Insomnia (rare)
Pregabaelin	Increase	None	Decrease	Decrease	None	None	Increase	None	Unknown

Vaughn BV, D'Cruz OF. Sleep and epilepsy. *Semin Neurol*. 2004;24:301–313

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Anticonvulsants

Tiagabine (Gabatril) Selective γ-aminobutyric acid (GABA) reuptake inhibitor (SGRI), which increases synaptic GABA availability via inhibition of the GAT-1 GABA transporter on presynaptic neurons and glial cells. Food delays the time to peak concentration from a mean of 0.9 to a mean of 2.6 hours, but does not change the total quantity absorbed. Because tiagabine has a short elimination half-life, the smoother absorption produced by concomitant intake of food helps in reducing excessive fluctuations in plasma drug levels during the dosing interval and, for this reason, it is recommended that the drug be taken at meal times, preferably at the end of the meal. Tiagabine is widely metabolized in humans, mainly by isoform CYP3A4 of the cytochrome P450 family. Less than 1% is excreted unchanged in the urine, and no active metabolites have been identified.. Pharmacokinetics are linear at doses up to 80 mg/day. Evidence for 6 mg/day effective when used as monotherapy or with non-inducing AEDs.

Pregabalin (Lyrica) pregabalin binds to the α-2-δ subunit of voltage-gated calcium (P/Q) channels, and allosterically modulates calcium (Ca) influx, reducing it by up to 40%. When fasting, oral bioavailability of pregabalin is excellent with >90% absorbed within 1 to 1.5 hours. Absorption is linear. 200mg BID or TID. Usual high dose 600mg/day. 90% is excreted unchanged in the urine. Pain efficacy. Side effects: Weight gain (10%), somnolence. No to minimal cognitive impairment.

Levetiracetam (Keppra)
When used in focal ischemia, levetiracetam had a 33% protective effect as measured by infarct volume with doses in a range similar to those used in the kindling effect.

Topiramate (Topamax)
In focal ischemia models, infarct volume was reported to be reduced by 50% to 80% when topiramate was given to rats at 40 mg/kg. In similar doses in animals undergoing global ischemia and treated 30 minutes after onset, cells were protected and behavioral skills preserved.

Gabapentin (Neurontin): Up to 3600mg/day.

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Tiagabine (Gabatril)

RAPID PUBLICATION

Tiagabine is Associated With Sustained Attention During Sleep Restriction: Evidence for the Value of Slow-Wave Sleep Enhancement?

James K. Walsh, PhD[1,2]; Angela C. Randazzo, PhD[1]; Kara Stone, MA[1]; Rhody Eisenstein, MD[1]; Stephen D. Feren, MD[1]; Susan Kajy, BA[1]; Pam Dickey, BS[1]; Timothy Roehrs, PhD[3]; Thomas Roth, PhD[3]; Paula K. Schweitzer, PhD[1]

[1]Sleep Medicine & Research Center, St. John's Mercy Medical Center/St. Luke's Hospital, St. Louis, MO; [2]Department of Psychology, St. Louis University, St. Louis, MO; [3]Henry Ford Hospital Sleep Disorders & Research Center, Detroit, MI

Tiagabine responder rates
as add-on for partial seizures (>50% decrease)

Reference	Number of patients	Daily dose mg/day	Tiagabine	Placebo
Richens et al. 1995	42	33	52%	24%[a]
Crawford et al. 1993	36	48	40%	10%[a]
Uthman et al. 1998	297	16	10%	8%
		32	20%	4%[b]
		56	31%	8%[c]
Sachdeo et al. 1997	318	32 (16 mg b.i.d.)	28%	8%[c]
		32 (8 mg q.i.d.)	23%	8%[b]
Kälviäinen et al. 1998	154	30	10%	5%
Ben-Menachem 1995	951	16-56	23%	8%

[a]p<0.05, [b]p<0.01, [c]p<0.01
Data from five double-blind placebo-controlled trials and from an integrated analysis of these studies.

- Dizziness - peak dose effect. Asthenia (lack of energy), nervousness, tremor, concentration difficulties, depressive mood, and language problems (difficulty in finding words or initiation of speech).
- Somnolence or drowsiness were not seen more frequently than placebo.
- CNS-related adverse events *during titration period only. No difference in side effects (Compared to placebo) after steady state.*
- BID increasing to TID for doses > 30 mg/day.
- Take with food. Start with 4 or 5 mg/day and gradually increase by 4-5mg/day weekly.
- Up to 80mg / day in three or four divided doses.

Lamotrigine (Lamictal)

- Attenuates the elevation of glutamate and aspartate release. Blocks voltage-dependent sodium (Na^+) channels.
- Up to 300mg/day monotherapy. 25-, 50-, 100-, and 200-mg tablets, and as dispersible chewable tablets in 2-, 5-, 25-, and 100-mg doses. 100% bioavailability with oral absorption. Potentially neuroprotective in ischemic injury studies. Hepatic clearance.
- Headache, asthenia, nausea, sleepiness, somnolence, drowsiness, and dizziness main side effects. 10% - rashes; 4% leading to withdrawal.
- SJS rare - in 1st 3 months of Tx.
- The combination of lamotrigine and valproic acid appears particularly effective for partial and tonic–clonic seizures. Up to 200/day with VPA

Slow dosing!!!

As add-on therapy	Concomitant antiepileptic drugs	
Adults	**Valproate**	**Others**
Weeks 1 and 2	12.5 mg daily[a]	50 mg daily
Weeks 3 and 4	25 mg daily	50 mg twice daily
Maintenance	50–100 mg[b] twice daily	100–200 mg[b] twice daily
Children	**Valproate**	**Others**
Weeks 1 and 2	0.15 mg/kg	0.6 mg/kg
Weeks 3 and 4	0.3 mg/kg	1.2 mg/kg
Increments	0.3 mg/kg	1.2 mg/kg
Maintenance	1–5 mg/kg[b]	5–15 mg/kg[b]
As monotherapy	**Adults**	**Children**
Weeks 1 and 2	25 mg daily	0.5 mg/kg
Weeks 3 and 4	25 mg twice daily	1 mg/kg
Maintenance	50–100 mg[b] twice daily	2–8 mg/kg[b]

[a]25 mg every other day is more common in the United States.
[b]Higher doses can be tried if seizures persist and the patient's tolerance is good.

Approved for bipolar 1 disorder

34

Sleep, Wake, and Traumatic Brain Injury

My daughter's first brain dissection

Thanks!!
for your attention

Questions?

Michael.Russo@US.Army.Mil
MikeBRusso@gmail.com

301-775-8731 (cell)
808-433-1619 (office)

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galantamine

- **BRAND NAME: Razadyne, Razadyne ER**
- **DRUG CLASS AND MECHANISM:** Galantamine is an oral medication used to treat patients with Alzheimer's disease. Galantamine is in a class of drugs called cholinesterase inhibitors that also includes tacrine (Cognex), donezepil (Aricept), and rivatigmine (Exelon). Cholinesterase inhibitors inhibit (block) the action of acetylcholinesterase, the enzyme responsible for the destruction of acetylcholine. Acetylcholine is one of several neurotransmitters in the brain, chemicals that nerve cells use to communicate with one another. Reduced levels of acetylcholine in the brain are believed to be responsible for some of the symptoms of Alzheimer's disease. By blocking the enzyme that destroys acetylcholine, galantamine increases the concentration of acetylcholine in the brain, and this increase is believed to be responsible for the improvement in thinking seen with galantamine. Galantamine was approved by the FDA in 2001. (The brand name of galantamine was changed in 2005 from Reminyl to Razadyne.)
- **PREPARATIONS:** Tablets: 4, 8, and 12 mg . Extended release capsules: 8, 16, and 24 mg. Oral solution: 4 mg/mL.
- **DOSING:** Galantamine usually is taken twice daily, preferably with the morning and evening meals. Most often, galantamine therapy is started with the lowest dose, 4 mg twice daily, for several weeks, and then continued at 8 mg twice daily for a further several week period. Thereafter, some patients may need a higher dose. Extended release capsules are taken once daily.
- **DRUG INTERACTIONS:** Drugs with anticholinergic properties and which cross into the brain, such as atropine, benztropine (Cogentin), and trihexyphenidyl (Artane) produce opposite effects of (counteract) galantamine and should be avoided during therapy with galantamine.
- Unlike donepezil (Aricept), galantamine does not increase blood levels of other medications and increase their risk for side effects.

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donepezil

- **BRAND NAME: Aricept, Aricept ODT**
- **DRUG CLASS AND MECHANISM:** Donepezil inhibits acetylcholinesterase, an enzyme responsible for the destruction of one neurotransmitter, acetylcholine. This leads to increased concentrations of acetylcholine in the brain, and the increased concentrations are believed to be responsible for the improvement seen during treatment with donepezil. Donepezil improves the symptoms but does not slow down the progression of Alzheimer's disease. Donepezil was approved by the FDA in 1996.
- **PREPARATIONS:** Aricept is available in 5 and 10 mg tablets. Aricept ODT (orally disintegrating tablets) also are available in 5 and 10 mg tablets.
- **DOSING:** Donepezil is generally taken once daily at night prior to retiring. Its absorption is not affected by food so that it may be taken with or without food.
- **DRUG INTERACTIONS:** Drugs with anti-cholinergic properties that can cross into the brain, such as atropine, benztropine (Cogentin), and trihexyphenidyl (Artane) counteract the effects of donepezil and should be avoided during therapy with donepezil.
- Donepezil is metabolized (eliminated) by enzymes in the liver. The rate of metabolism of donepezil may be increased by medications that increase the amounts of these enzymes, such as carbamazepine (Tegretol), dexamethasone (Decadron), phenobarbital, phenytoin (Dilantin), and rifampin (Rifadin). By increasing elimination, these drugs may reduce the effects of donepezil.
- Ketoconazole (Nizoral) has been shown to block the enzymes in the liver that metabolize donepezil. Therefore, concurrent use of ketoconazole and donepezil may result in increased concentrations of donepezil in the body and possibly lead to donepezil side effects. Quinidine (Quinidex, Quinaglute) also has been shown to inhibit the enzymes that metabolize donepezil and may cause donepezil side effects.
- **SIDE EFFECTS:** The most frequently reported side effects associated with donepezil include headache, generalized pain, fatigue, dizziness, nausea, vomiting, diarrhea, loss of appetite, weight loss, muscle cramping, joint pain, insomnia, and increased frequency of urination.
- Tacrine (Cognex) is associated with liver toxicity and I do not use it. Donepezil does not appear to be associated with liver toxicity.

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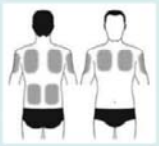
rivastigmine

- **BRAND NAME: Exelon**
- **DRUG CLASS AND MECHANISM:** Rivastigmine books both acetylcholinesterase AND butylcholinesterase. BAchAse is the secondary pathway for the metabolism of Ach. By blocking both enzyme s that destroys acetylcholine, rivastigmine is more efficacious at increasing the concentration of acetylcholine in the brain.
- **PREPARATIONS:** Patches: 4.6mg/24hrs for one month, then may increase to 9mg/24hrs. I don't use the oral form. May leave previous patch on (Two patches total) for intermediate dose.
- **DOSING:** One patch q D to chest, back, abdomen, shoulders, arms for at least one month before increasing.
- **DRUG INTERACTIONS:** Drugs with anticholinergic effects and which cross into the brain, such as atropine, benztropine (Cogentin), and trihexyphenidyl (Artane) oppose the effects of rivastigmine and should be avoided during therapy with rivastigmine.
- Unlike donepezil (Aricept), rivastigmine does not cause the blood levels of other medications to rise and increase their risk for side effects.
- **SIDE EFFECTS:** Few patients become nauseated on the 4.6mg/24hr dose. Side effects increase with 9mg/24 hr patch. Between one in five and one in four patients lose weight during rivastigmine therapy (about 7 to 10 pounds, on average). One in six patients experiences a loss of appetite. About one in fifty patients develops dizziness. Overall, 15% of patients (between one in seven and one in six) discontinue therapy due to side effects.



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Appendix I.

Defense Centers of Excellence (DCoE)

Dr. George Johnson
TBI Directorate


DEFENSE CENTERS OF EXCELLENCE
For Psychological Health & Traumatic Brain Injury
DCoE TBI Research Role & TBI Research Gaps
26 August 2010


Overview
DCoE Research Directorate Mission/Activities
DCoE Research Directorate Output/Impact
Research Coordination
Summary of Funded DoD Research
TBI Research Initiatives
TBI Research Goals
TBI Research Questions
TBI Research Emphases
Resilience • Recovery • Reintegration
POC: George P. Johnson MD
george.johnson@tma.osd.mil
(301) 295-9383
2


DCoE Research Function Mission/Activities
Mission:
To support and promote research and systematic analyses in Psychological Health and Traumatic Brain Injury to improve the health and wellness of military personnel and their families
Activities:
DCoE does NOT fund research, but advises DoD on investment strategy
Lead the advancement of PH/TBI knowledge by strategically managing research
Foster collaborations and partnerships
Resilience • Recovery • Reintegration
POC: George P. Johnson MD
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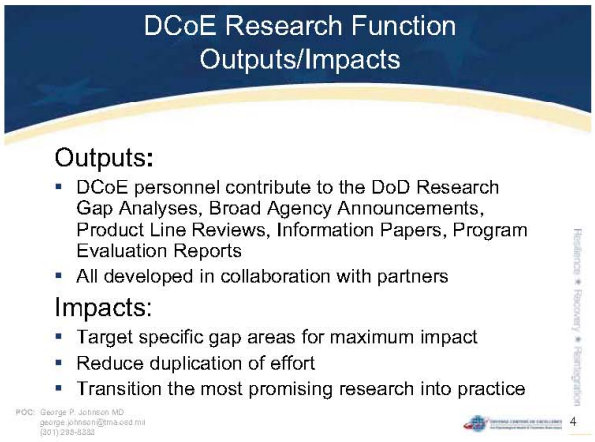
(301) 295-9383
3


DCoE Research Function Outputs/Impacts
Outputs:
DCoE personnel contribute to the DoD Research Gap Analyses, Broad Agency Announcements, Product Line Reviews, Information Papers, Program Evaluation Reports
All developed in collaboration with partners
Impacts:
Target specific gap areas for maximum impact
Reduce duplication of effort
Transition the most promising research into practice
Resilience • Recovery • Reintegration
POC: George P. Johnson MD
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(301) 295-9383
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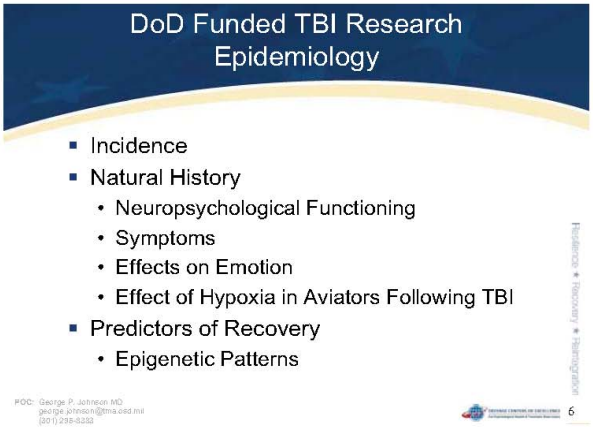
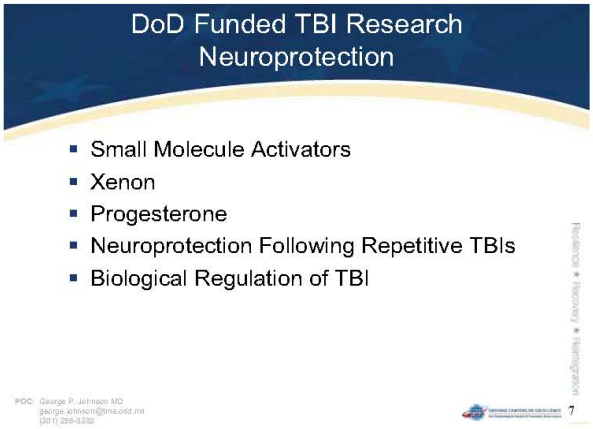
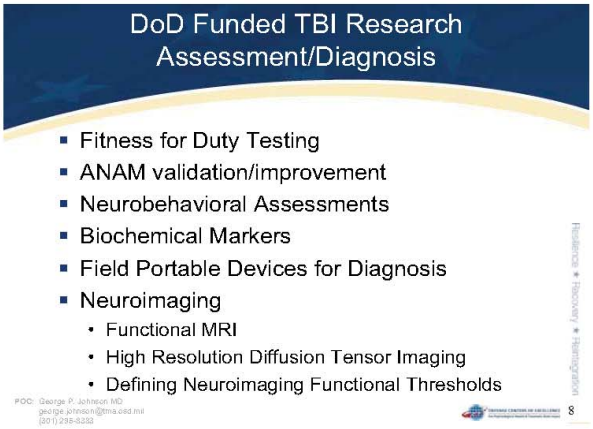
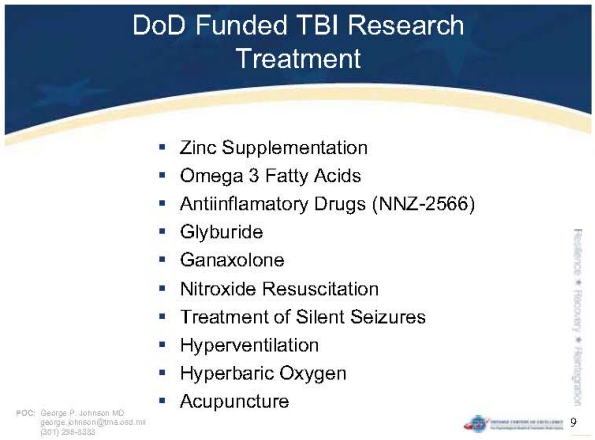
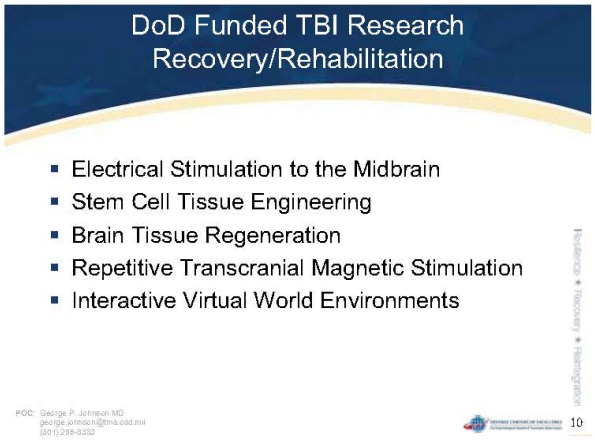
DCoE Research Coordination
Armed Services Biomedical Research Evaluation and Management Committee
Facilitate coordination and prevent unnecessary duplication of effort within DoD biomedical research and development
Defense Health Program Medical Research & Development Office, FHP&R
Develop R&D planning, programming, budgeting, and execution (PPB&E) strategies
Communicate PPB&E guidance to organizations using DHP RDT&E funds
Focal point for all DHP medical R&D actions and communications
Joint Programming Committees (JPCs)
Provide input into funding requirements by functional areas, TBI spread over several different JPCs
Representatives from the Services, VA, NIH, OASD(HA), DARPA and DCoE
Same groups used for Programmatic Reviews of research proposals
5


DoD Funded TBI Research Epidemiology
Incidence
Natural History
Neuropsychological Functioning
Symptoms
Effects on Emotion
Effect of Hypoxia in Aviators Following TBI
Predictors of Recovery
Epigenetic Patterns
6

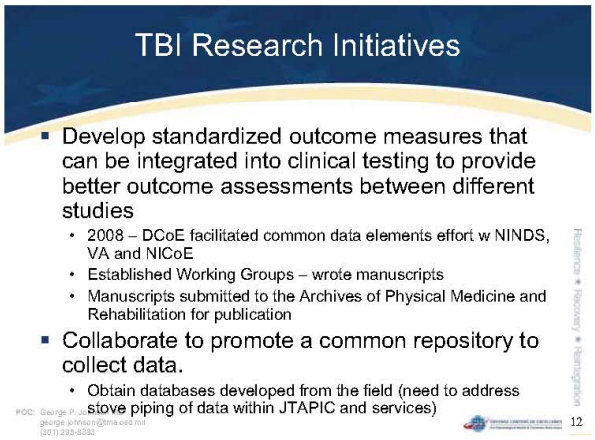

DoD Funded TBI Research Neuroprotection
Small Molecule Activators
Xenon
Progesterone
Neuroprotection Following Repetitive TBIs
Biological Regulation of TBI
7

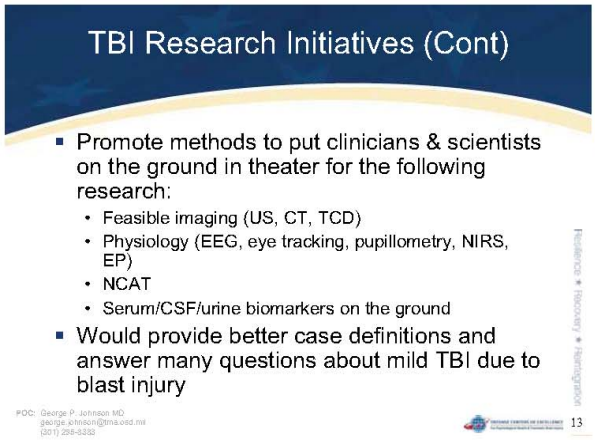

DoD Funded TBI Research Assessment/Diagnosis
Fitness for Duty Testing
ANAM validation/improvement
Neurobehavioral Assessments
Biochemical Markers
Field Portable Devices for Diagnosis
Neuroimaging
Functional MRI
High Resolution Diffusion Tensor Imaging
Defining Neuroimaging Functional Thresholds
8

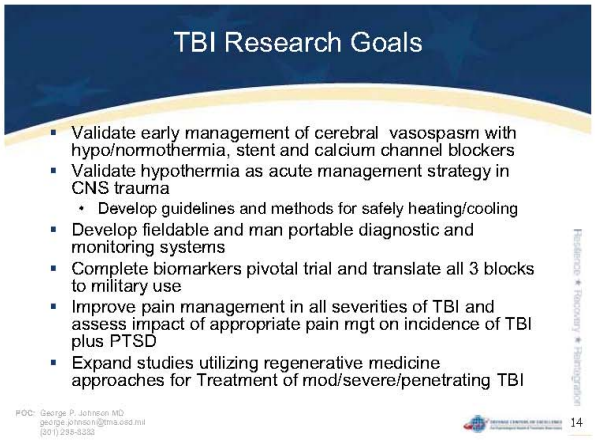

DoD Funded TBI Research
Treatment
Zinc Supplementation
Omega 3 Fatty Acids
Antiinflamatory Drugs (NNZ-2566)
Glyburide
Ganaxolone
Nitroxide Resuscitation
Treatment of Silent Seizures
Hyperventilation
Hyperbaric Oxygen
Acupuncture
Resilience • Recovery • Reintegration
9

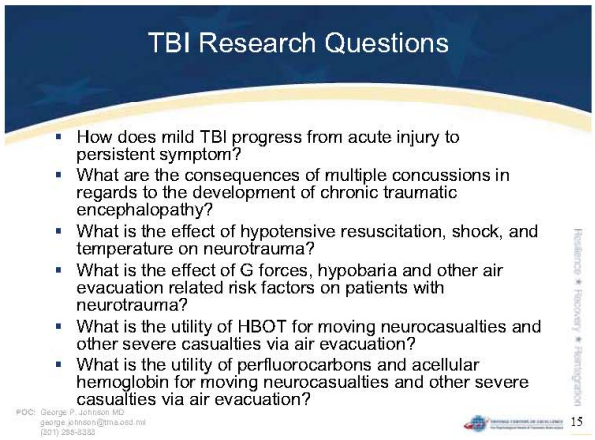

DoD Funded TBI Research
Recovery/Rehabilitation
Electrical Stimulation to the Midbrain
Stem Cell Tissue Engineering
Brain Tissue Regeneration
Repetitive Transcranial Magnetic Stimulation
Interactive Virtual World Environments
Resilience • Recovery • Reintegration
10

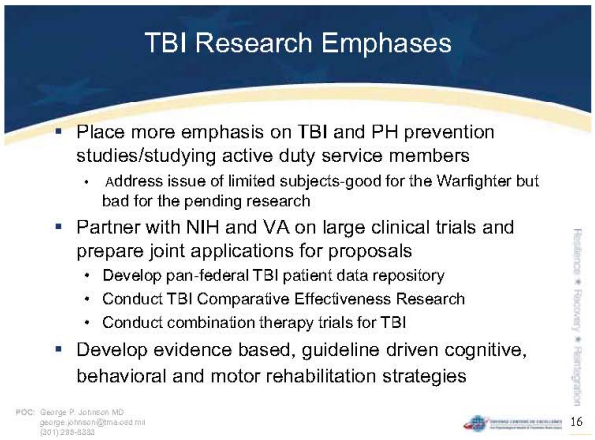

Gap Summary Sources
Defense Health Program, Strategic Review and Analysis, 27 JULY 2010
Joint Program Committee for Military Operational Medicine (JPC–5)
Joint Program Committee for Combat Casualty Care (JPC–6)
Joint Program Committee for Clinical and Rehabilitative Medicine (JPC-8)
Resilience • Recovery • Reintegration
11

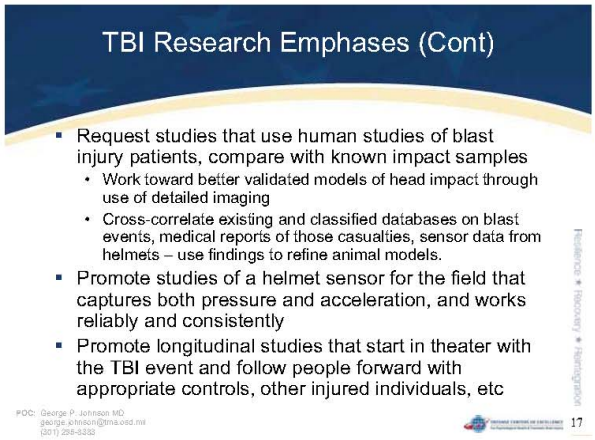

TBI Research Initiatives
Develop standardized outcome measures that can be integrated into clinical testing to provide better outcome assessments between different studies
2008 – DCoE facilitated common data elements effort w NINDS, VA and NICoE
Established Working Groups – wrote manuscripts
Manuscripts submitted to the Archives of Physical Medicine and Rehabilitation for publication
Collaborate to promote a common repository to collect data.
Obtain databases developed from the field (need to address stove piping of data within JTAPIC and services)
Resilience • Recovery • Reintegration
12


TBI Research Initiatives (Cont)
Promote methods to put clinicians & scientists on the ground in theater for the following research:
Feasible imaging (US, CT, TCD)
Physiology (EEG, eye tracking, pupillometry, NIRS, EP)
NCAT
Serum/CSF/urine biomarkers on the ground
Would provide better case definitions and answer many questions about mild TBI due to blast injury
POC: George P. Johnson MD
george.johnson@tma.osd.mil
(301) 295-9333
13


TBI Research Goals
Validate early management of cerebral vasospasm with hypo/normothermia, stent and calcium channel blockers
Validate hypothermia as acute management strategy in CNS trauma
Develop guidelines and methods for safely heating/cooling
Develop fieldable and man portable diagnostic and monitoring systems
Complete biomarkers pivotal trial and translate all 3 blocks to military use
Improve pain management in all severities of TBI and assess impact of appropriate pain mgt on incidence of TBI plus PTSD
Expand studies utilizing regenerative medicine approaches for Treatment of mod/severe/penetrating TBI
POC: George P. Johnson MD
george.johnson@tma.osd.mil
(301) 295-9333
14


TBI Research Questions
How does mild TBI progress from acute injury to persistent symptom?
What are the consequences of multiple concussions in regards to the development of chronic traumatic encephalopathy?
What is the effect of hypotensive resuscitation, shock, and temperature on neurotrauma?
What is the effect of G forces, hypobaria and other air evacuation related risk factors on patients with neurotrauma?
What is the utility of HBOT for moving neurocasualties and other severe casualties via air evacuation?
What is the utility of perfluorocarbons and acellular hemoglobin for moving neurocasualties and other severe casualties via air evacuation?
POC: George P. Johnson MD
george.johnson@tma.osd.mil
(301) 295-9333
15


TBI Research Emphases
Place more emphasis on TBI and PH prevention studies/studying active duty service members
Address issue of limited subjects-good for the Warfighter but bad for the pending research
Partner with NIH and VA on large clinical trials and prepare joint applications for proposals
Develop pan-federal TBI patient data repository
Conduct TBI Comparative Effectiveness Research
Conduct combination therapy trials for TBI
Develop evidence based, guideline driven cognitive, behavioral and motor rehabilitation strategies
POC: George P. Johnson MD
george.johnson@tma.osd.mil
(301) 295-9333
16


TBI Research Emphases (Cont)
Request studies that use human studies of blast injury patients, compare with known impact samples
Work toward better validated models of head impact through use of detailed imaging
Cross-correlate existing and classified databases on blast events, medical reports of those casualties, sensor data from helmets – use findings to refine animal models.
Promote studies of a helmet sensor for the field that captures both pressure and acceleration, and works reliably and consistently
Promote longitudinal studies that start in theater with the TBI event and follow people forward with appropriate controls, other injured individuals, etc
Resilience • Recovery • Reintegration
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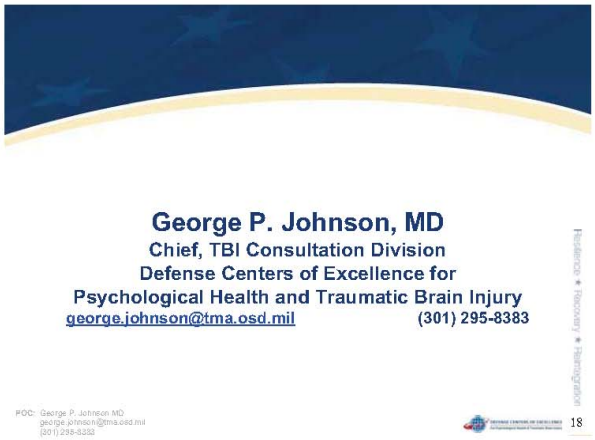
George P. Johnson, MD
Chief, TBI Consultation Division
Defense Centers of Excellence for
Psychological Health and Traumatic Brain Injury
george.johnson@tma.osd.mil
(301) 295-8383
Resilience • Recovery • Reintegration
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Appendix J.

Simulation Training Research-Trauma Man

Capt Andrew Hall
81 MDG

Medical Readiness: Animal Training in the age of Simulation

Capt. Andrew B. Hall, USAF MC
81st MSGS/SGCQ

Overview

- Emergency Medical Needs
- Animal Training
- Simulator Training
- Conclusions
- Current and Future Research

Emergency Medical Needs

- Military Medicine Requirements:
  - Well trained initial responders and definitive care providers able to perform life saving procedures in potentially austere and complex conditions

Emergency Medical Needs

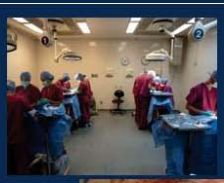
Animal Training

- Benefits:
  - Real tissues, bleeding, and effects
- Disadvantages:
  - Cost of upkeep (Facilities and Staff)
  - Ethical concerns

Animal Training

- Requirements:


Animal Training


Simulator Training

- Benefits:
  - Controllable variation
  - Low cost of upkeep (Dedicated facility and staff not required)
  - No ethical concerns
- Disadvantages:
  - Lack of exact tactile sensation
  - Lack of real consequences
  - Lack of detailed anatomy

Simulator Training



Current Research

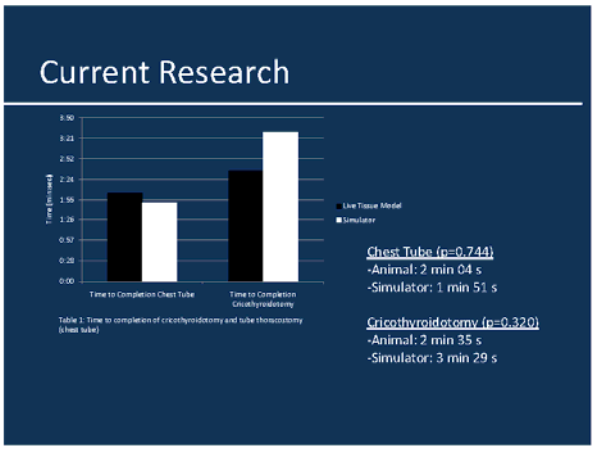
- Limited analysis comparing outcomes of animal and simulator training
  - Historical research based on subjective analysis and opinion and most test to just see if simulation works
    - Block E, et al. 2002: 3.64/5 on satisfaction survey for simulation of emergency procedures
    - Sutherland L, et al. 2006: No significant differences found between studies testing training methods (nearly all comparing computer/sim/no training)
    - Lynagh M, et al. 2007: Lit Review- 70% of studies found improvement in procedural skills

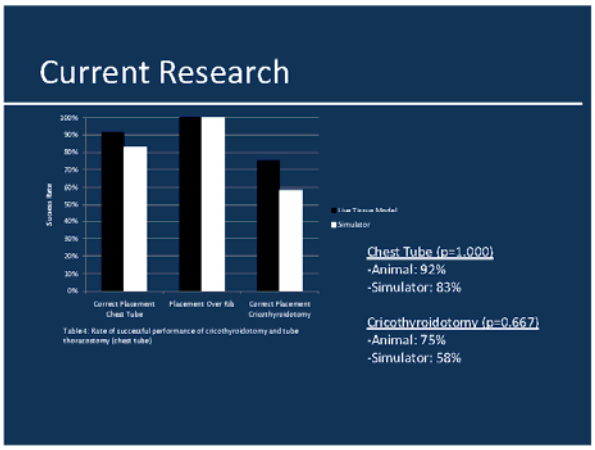
Current Research

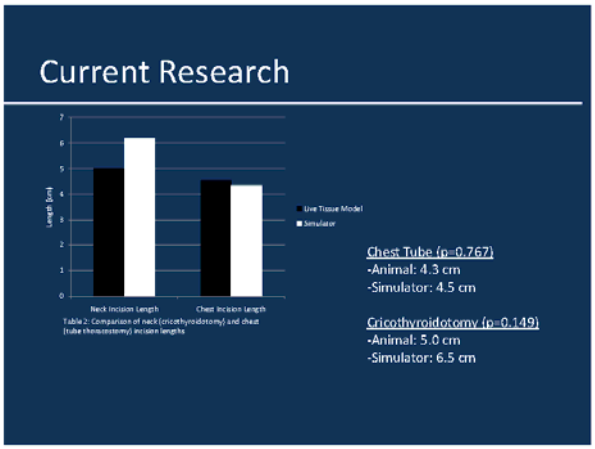
- Direct comparison to human outcomes difficult
  - Unethical to randomize trainees and test performance in emergency situations where lives are at stake

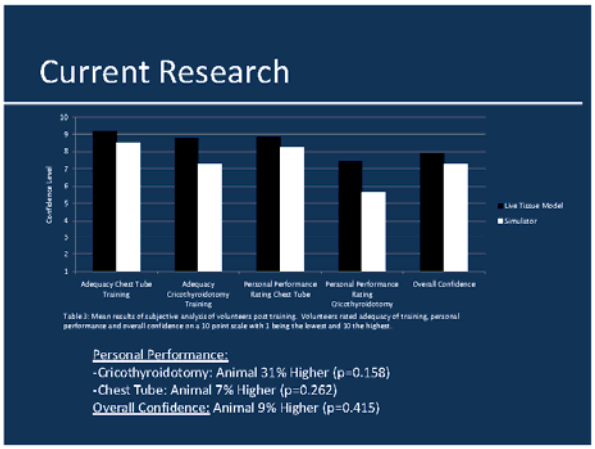
Current Research

- 81st TRW medically naïve volunteers trained on animal model (pig) and TraumaMan simulator
- 7 days post training objectively assessed on fresh human cadavers


Current Research
Time (minsec)
8:50
8:21
2:52
2:24
1:55
1:26
0:57
0:28
0:00
Time to Completion Chest Tube
Time to Completion Cricothyroidotomy
Live Tissue Model
Simulator
Table 1: Time to completion of cricothyroidotomy and tube thoracostomy (chest tube)
Chest Tube (p=0.744)
-Animal: 2 min 04 s
-Simulator: 1 min 51 s
Cricothyroidotomy (p=0.320)
-Animal: 2 min 35 s
-Simulator: 3 min 29 s


Current Research
Success Rate
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Correct Placement Chest Tube
Placement Over Rib
Correct Placement Cricothyroidotomy
Live Tissue Model
Simulator
Table4: Rate of successful performance of cricothyroidotomy and tube thoracostomy (chest tube)
Chest Tube (p=1.000)
-Animal: 92%
-Simulator: 83%
Cricothyroidotomy (p=0.667)
-Animal: 75%
-Simulator: 58%


Current Research
Length (cm)
7
6
5
4
3
2
1
0
Neck Incision Length
Chest Incision Length
Live Tissue Model
Simulator
Table 2: Comparison of neck (cricothyroidotomy) and chest (tube thoracostomy) incision lengths
Chest Tube (p=0.767)
-Animal: 4.3 cm
-Simulator: 4.5 cm
Cricothyroidotomy (p=0.149)
-Animal: 5.0 cm
-Simulator: 6.5 cm


Current Research
Confidence Level
10
9
8
7
6
5
4
3
2
1
Adequacy Chest Tube Training
Adequacy Cricothyroidotomy Training
Personal Performance Rating Chest Tube
Personal Performance Rating Cricothyroidotomy
Overall Confidence
Live Tissue Model
Simulator
Table 3: Mean results of subjective analysis of volunteers post training. Volunteers rated adequacy of training, personal performance and overall confidence on a 10 point scale with 1 being the lowest and 10 the highest
Personal Performance:
-Cricothyroidotomy: Animal 31% Higher (p=0.158)
-Chest Tube: Animal 7% Higher (p=0.262)
Overall Confidence: Animal 9% Higher (p=0.415)

Conclusions

- Trends indicate improved outcomes after animal training for cricothyroidotomy. No obvious trends for improvement in chest tube performance.
- Improved confidence/self-efficacy may be important in battlefield results. Further evaluation needed.

Future Research

- Multi-center trial with standardized simulator/animal training with cadaver comparison
- Other Simulators
  - 140 subject randomized comparison of ultrasound guided venous access simulator compared to animal training with pre and post self-efficacy evaluation

Bibliography

- Stajkovic A, Luthans F. Self-Efficacy and Work-Related Performance: A Meta-Analysis. Psychological Bulletin, 1998. 124(2):240-261

Questions?

Appendix K.

Joint Technical Coordinating Group (JTCG) Updates

Col Ray Santullo
Air Force Liaison to JTCG

Headquarters U.S. Air Force

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AFMS JTCG/JPC Update

Year of the Air Force Family

26 Aug 2010
Ray F Santullo, Col, USAF, BSC
AFMS Liaison to JTCG
Assistant to Secretariat ASBREM

1

Overview

- Disclaimer
- Defense Medical Research Program (DMRDP)
- Joint Technology Coordinating Groups (JTCG) and Joint Program Committees (JPC)
- DHP Funded AFMS Research
- How to Get There From Here

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Defense Medical Research and Development Program (DMRDP)

"…Beyond the recent one-time increase by the Congress for this specific purpose, I request the development of a tailored plan to provide R&D investments that advance state of the art solutions for world class medical care with an emphasis on Post Traumatic Stress Disorder, Traumatic Brain Injury, Prosthetics, Restoration of Sight & Eye-Care, & other conditions directly relevant to the injuries our soldiers are currently receiving on the battlefield." *26 June, 2008*

"…Continue the steady growth in medical research and development by requesting $400 million more than last year." *6 April, 2009*

Robert M. Gates, Secretary of Defense,

LEGISLATIVE MANDATES

National Defense Authorization Act for FY 2006, H.R. 1815
Sec. 256 –Prevention, Mitigation, & Treatment of Blast Injuries

John Warner National Defense Authorization Act for FY 2007, H.R. 5122
Sec. 720 –Longitudinal Study on Traumatic Brain Injury
Sec. 741 –Pilot Projects on Early Diagnosis & Treatment of Post Traumatic Stress Disorder & Other Mental Health Conditions

The National Defense Authorization Act for FY 2008 H.R. 4986
Title XVI –Wounded Warrior Matters
Centers of Excellence in the Prevention, Diagnosis, Mitigation, Treatment & Rehabilitation of Traumatic Brain Injury, Post-Traumatic Stress Disorder & Eye Injuries

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3

Guidance for Development of the Force (GDF)

Functional Area	Gap Status (Number of Gaps)		
	Green	Yellow	Red
Joint Human Performance Enhancement	-	9	24
Joint Health Surveillance, Intelligence & Preventive Medicine	-	-	3
Joint Casualty Management	1	9	14
Joint Patient Movement	-	2	2
Joint Medical Logistics & Infrastructure Support	-	-	3
Joint Theater Medical Command & Control	-	-	2

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4

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Types of RDT&E Money

- **6.1 Basic Medical Research Science** – attaining greater knowledge and understanding of fundamental principles of science and medicine
- **6.2 Applied Biomedical Technology** – refinement of concepts and ideas into potential solutions with a view toward evaluating technical feasibility
- **6.3 Medical Technology Development** – development of candidate solutions and components of early prototype systems for test and evaluation, including support of early stage clinical trials
- **6.4 Advanced Component Development** – clinical trials for FDA licensed products and accelerated transition of FDA regulated and non-regulated products and medical practice guidelines to operational users through clinical and field validation studies
- **6.5 Medical Systems Development** – development of demonstration of medical commodities prior to initial full-rate production and fielding, including initial operational test and evaluation and clinical trials
- **6.6 Management Support** – infrastructure and civilian salary support
- **6.7 Medical Systems Sustainment Activities** – pre-planned product improvement of fielded medical products and evaluation of the effectiveness of fielded products, therapies, treatments or medical guidelines

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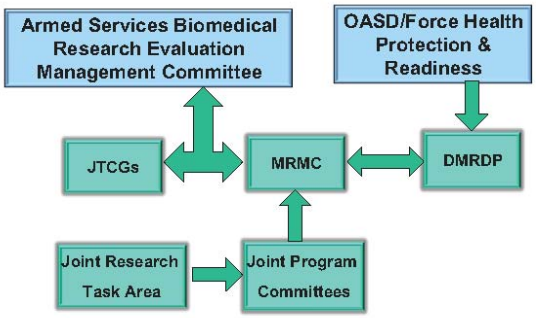
Joint Program Committees



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JTCG Organization

Armed Services Biomedical Research Evaluation Management Committee

JTCG/JPC	Chair	AFMS Rep
1 - Bio and Medical Informatics	Col Karl Friedl (USAMRMC)	Col Deb Burgess (AETC/SG2)
2 – Military Infectious Diseases	Col Julia Lynch (USAMRMC)	Lt Col Victor Macintosh (711 HPW)
5 – Military Operational Medicine	Col Carl Castro (USAMRMC)	Maj Gerardo Ramos (711 HPW)
6 – Combat Casualty Care	Col Dallas Hack (USAMRMC)	Col David Smith (59 MDW)
7 – Radiation Health Effects	Col Patricia Lillis-Hearne (AFRRI)	Mr Kevin Martilla (711 HPW)
8 – Clinical Medicine and Rehabilitation	Col Janet Harris (USAMRMC)	Col Richard Griffith (AFMSA/SGR)

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JTCG Research Tasks

- JTCG 1 - Medical Informatics
  - Health Information Technologies
  - Computational sciences related to organization, development, training, and utilization of medical knowledge
- JTCG 2 - Military Infectious Disease
  - Medical Readiness
  - Vaccines
  - Biotechnology
  - Prophylaxis/treatment drugs
  - Diagnostics/prognostics
  - Vector Control
  - Medical C4ISR
  - HIV countermeasures
- JTCG 5 - Military Operational Medicine
  - Injury prevention and reduction
  - Psychological Health and resilience
  - Physiological health
  - Environmental health and protection
- JTCG 6 - Combat Casualty Care
  - Trauma Care and Resuscitation
  - Blood replacement on Battlefield
  - Technology to support combat medic
  - Acute pain management
  - Burn & acute wound management
- JTCG 8 - Clinical and Rehabilitative Medicine Research Program
  - Rehabilitation & prosthetics
  - Regenerative medicine & transplants
  - Restore vision
  - Pain management

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DMRDP Submission Process

- Program Announcements are posted at grants.gov and/or USAMRAA websites
  - Links to announcements sent to MAJCOM/SGR
- Principle Investigators submit directly to website
  - Read the PA carefully – stay on task
  - Know the timelines
  - Know the type of Award (IM vs EM)
- Scientific and Programmatic polish

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JPC Review Criteria

Scientific/Peer Review Criteria:

- Specific Hypothesis/Aims Impact
- Scientific Rationale
- Approach/Methods
- Personnel Qualifications and Level of Effort
- Technical Risks
- Feasibility of Major Milestones
- Estimated Budget

Programmatic Review Criteria:

- Responsiveness to Research Projects and Tasks
- Programmatic Relevance in Terms of Military Need
- Ratings and Evaluations of the Scientific Peer Reviewers
- Portfolio Balance Across the DOD

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JPC Review Process

- Review Proposals
  - Each proposal is discussed by assigned reviewers both in terms of scientific merit and programmatic relevance
- Score Proposals
  - All members discuss the reviewers comments and score the proposal, to include comments
- Rank Proposals
  - Sort by average scores, determine funding running totals and establish funding cutoff line
- Evaluate Proposal Ranking
  - Discuss proposals and move above/below funding cutoff line based on research tasks
- Establish Order of Merit List (OML)
- Concurrence Vote by All Members
  - Non concurrence vote requires specific comments

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FY 10 DHP Funded AFMS Research Projects

Type	Title	PI
6.1	Psychological Health and Well Being for Military Personnel and Families	Lt Col Cigrang
6.1	Evaluation of Suicidality, Cognitions and Pain Experience (ESCAPE)	Capt Kanzler
6.2	Project BLAST (Balad Longitudinal Assessment of the Symptoms of TBI)	Maj Baker
6.3	Photomedicine Research for the Wounded Warrior	Dr Scholssberg
6.4	Comparative Study Evaluating Specific Qualities of the VAID	Col Carter
6.4	Efficacy and Safety of Frozen RBCs for Transfusion in Trauma Patients	Col Hansen
6.4	Determining the 02 Requirements Using 02 concentrator at Altitude	Col Dorlac
6.4	Increased Compliance and Functionality of Traumatic Wound Scars with Fraxellated C02 Laser	Lt Col Hivnor
6.4	Hosting of Clinical Looking Glass Prototype	Col Bonnema
6.4	CarePoint Enhancements	Lt Col Harvey
6.5	Comprehensive Adult Extracorporeal Support Program	Lt Col Cannon
6.7	SMEED Evolution	Lt Col Walter

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Year of the Air Force Family

FY 10 DHP Funded AFMS Research Projects

Type	Title	PI
6.7	Joint Operational Training for the Use of Temporary Vascular Shunts by Military Surgeons in the Management of Non Compressible Hemorrhage	Col(s) Rasmussen
CSI	Characterization of the Human Proteomic Response to Hydrocodone	Lt Col Berbarta
CSI	Investigation of Chronic Pain Following Traumatic Injury	Maj Chao
CSI	Determine Optimum Dose/Timing of IV Methamphetamine to Decrease Neuronal Cellular Destruction and Improve Neurocognitive Outcomes in Rats with Mild/Moderate/Severe TBI	Dr Poulsen
SBIR	Synthetic Tissue Trainer	Mr Wier
SBIR	Medical Gaming	Mr Wier

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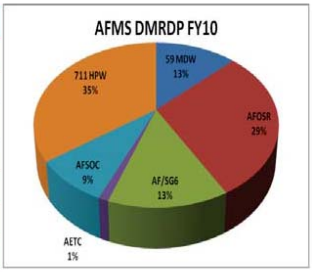
FY 10 DHP Funded AFMS Research Projects

EM	Projects	FY10 $K
711 HPW	3	$6,198.0
AFOSR	1	$5,161.1
AF/SG6	2	$2,381.0
59 MDW	8	$2,272.4
AFSOC	2	$1,524.0
AETC	2	$200.0
Total	**18**	**$17,736.5**



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Year of the Air Force Family

How to Get There From Here

- If you're not at the table you're on the menu…Engage
- Spend your funds early and often…Know the rules
- Operate as a symphony not a solo act…See the big picture
- Continuity…Avoid critical points of failure
- Focus on military relevance and avoid unnecessary duplication...AF-specific programs should be core AF funded
- What is the deliverable?...Your Quad sells your proposal
  - Past performance…Speak to your success
  - Portfolio balance…Deconflict/enhance existing programs
- Demonstrate active management of portfolio…Be worthy
  - Enabling support to execution platforms
  - Translation/transition plan?

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AFMS Modernization Thrust Areas

FORCE HEALTH PROTECTION	ENROUTE CARE	OPERATIONAL MEDICINE	HUMAN PERFORMANCE	HEALTH INFORMATICS	EXPEDITIONARY MEDICINE
Prevention of injury and illness and early recognition of threats	Continuum of care from point of injury to definitive care	Treatment in-garrison setting	Enhancing performance in challenging environments	Providing trusted information management and technology health care support	Expeditionary medical care in contingency operations
Emerging Threats	Aeromedical Evacuation	Clinical Medicine Enhancements	Environmental Safety and Occupational Health	Information Assurance	SIMDIS
Surveillance	CCATT	Psychological Health	Occupational Standards	Enterprise Architecture	Expeditionary Trauma Resuscitation
Infectious Disease	MEDEVAC	TBI/Psych-Health	Nutritional Medicine	Data Management	Expeditionary Trauma Care
Occupational Toxicology	CASEVAC	Regenerative Medicine/Definitive Care	Situational Awareness	Portfolio Management	Contingency Operations
Countermeasures	CASF	Personalized Health Care	Occupational Selection	Compliance	Humanitarian Operations
		Clinical Patient Safety	Cognition Research	Infrastructure Services	Global Reach Logistics
		Vision Restoration /Rehab	Fit and Healthy Force	Promote IM/IT Innovation	Emerging Threats
			Performance Sustainment	Sustain workforce	Irregular Warfare
			Performance Optimization		
			Performance Enhancement		
			Fatigue Management		
			Audio/Visual Enhancement		
			Team Performance		
			Modeling and Simulation		
			Currency and Competency		

Year of the Air Force Family

2 Wing Research Construct

711th Human Performance Wing:

Aerospace Medicine Research

- *CSTARS and USAFSAM*
- *Airman Performance in Adverse Environments*
- *Transportation Portion of AE/Enroute Care,*
- *Aircrew Health, Standards and Selection*
- *Human Systems Integration*
- *Global Health Surveillance*
- *Public Health Diagnostics & Epidemiologic Studies*
- *Toxicology, DE Health Effects*
- *Aerospace medicine GME research*
- *AE Modeling & Simulation Training*

59th Medical Wing:

Clinical and Translational Research

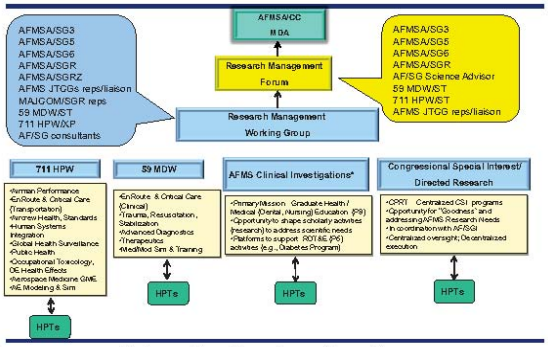
- *Enroute Care and Combat Casualty Care – Trauma, Resuscitation & Stabilization*
- *Personalized Medicine – Adv Diagnostics, Therapeutics, Med Mod Simulation & Training*
- *Enroute Care Research Center*
- *Clinical Research Division*
- *Advanced Diagnostic Labs*
- *Diabetes COE and Diabetes Pediatric Program*
- *Partnerships for Translational Research*
- *Clinical Trials*
- *Research supporting GME Accreditation*
- *Research supporting Trainee Health Maintenance*

Other Critical Research Platforms

- *NURSING RESEARCH SITES*
- *CLINICAL INVESTIGATION SITES/FACILITIES*
- *US AIR FORCE ACADEMY*

Year of the Air Force Family

AFMS Research Portfolio Governance



Year of the Air Force Family

How Can I Help?

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Visit the JTCG CoP at
https://afkm.wpafb.af.mil/ASPs/CoP/

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FY 10 DHP Funded AFMS Research

Type	Projects	FY10 $K	FY11 $K
6.1	2	$178.0	$329.0
6.2	1	$150.9	$301.9
6.3	1	$5,161.1	$0.0
6.4 Adv Devices	4	$1,484.0	$1,084.4
6.4 Hemorrhage	1	$3,850.0	$1,440.0
6.4 Medical IM/IT	2	$2,381.2	$0.0
CSI TBI/PH	3	$2,505.0	$851.0
6.7	2	$324.0	$338.0
SBIR	2	$200.0	$0.0
Totals	18	$16,296.7	$4,407.8

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Year of the Air Force Family

FY2010 RDT&E Budget

Defense Health Program
FY 2010 RDT&E Budget Estimates

0601101HP In-House Laboratory Independent Research ($2.817M)
0601117HP Basic Operational Medical Research Sciences ($56.720M)
0602115HP Applied Biomedical Technology ($92.846M)
0602787HP Medical Technology ($3.417M)
0603002HP Medical Advanced Technology ($0.737M)
0603115HP Medical Development ($113.316M)
0604110HP Medical Products Support/Advanced Concept Development ($198.015M)
0605013HP Information Technology Development ($124.410M)
0605145HP Medical Products & Support Systems Development ($0.824M)
0605502HP Small Business Innovative Research Program ($0.000M)
0607100HP Medical Products & Capabilities Enhancement Activities ($20.000M)

TOTAL ($613.102)

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UNITED STATES AIR FORCE
MEDICAL SERVICE